ELECTRICAL REVIEW

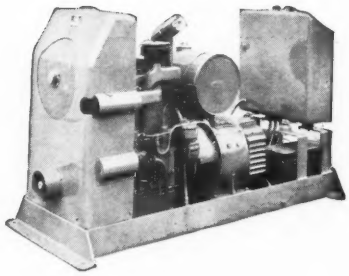
SOCIAL SCIENCE)

13th APRIL, 1951

Important new MAZDA Fittings announcement – see page 53

PETBOW

Diesel-driven A.C. Generating Plant



The confidence of hundreds of users in the lonelier places of the world is the surest proof we can offer that these are the world's finest small generating sets.

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The Heatrae DOT Automatic Electric Water Heater represents the culmination of 30 years' experience in the building of simply-designed, well-made and foolproof Water Heaters that can "stand on their own" with a minimum of attention.

Heatrae DOT is *fully-automatic* and fitted with a high-precision thermostat that controls consumption of current within most economical limits.

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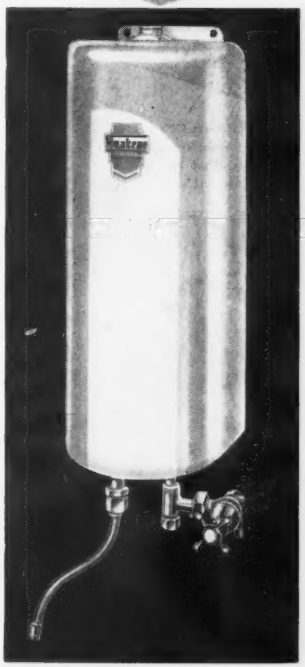

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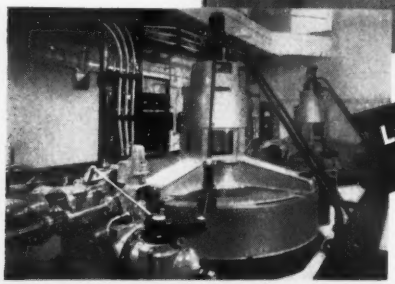
Hydro-Electric Generators

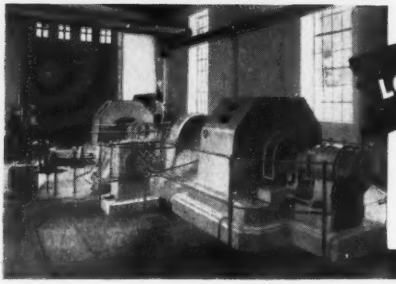
PEEBLES

LOCH FANNICH

13,333 kVA, 11,000 volt, 500 r.p.m. vertical-shaft generator for the Loch Fannich scheme of the North of Scotland Hydro-Electric Board.



LOCH MORAR



LOCHALSH

HORIZONTAL & VERTICAL TYPES

DESIGNED TO INDIVIDUAL SPECIFICATIONS

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Bruce Peebles are building numbers of hydro-electric generators in sizes up to 24,700 kVA, for various schemes of the North of Scotland Hydro-Electric Board. Views at left show the first two schemes inaugurated by the Board.

Loch Morar ; Two 625 kVA, 415 volt, 333 r.p.m.

Lochalsh ; Two 625 kVA, 415 volt, 750 r.p.m.

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BRUCE PEEBLES & CO. LTD., EDINBURGH, SCOTLAND

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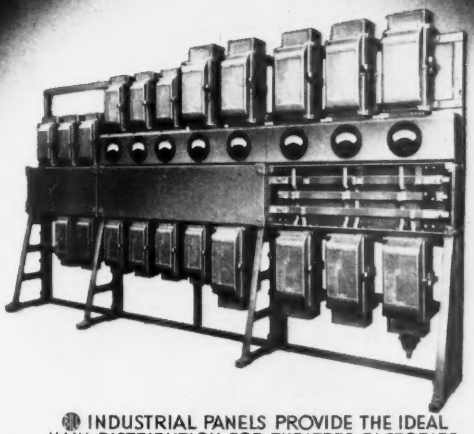

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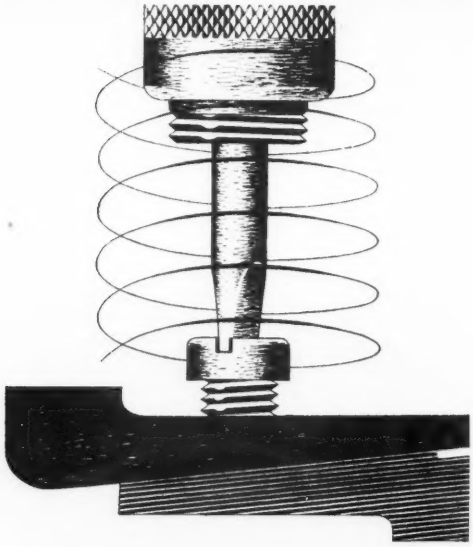
It all comes into Switchcraft



PUTTING A SPIN ON THE SCREW If a screw could get dizzy, it would in the MEM works where deft-fingered girls use power operated screwdrivers to drive home a dozen screws in a few seconds. MEM mass precision means just this kind of speeding up in every process of manufacture and assembly. That's why fine engineering by MEM costs you surprisingly little.

Send for latest list on Auto-Memota starters.

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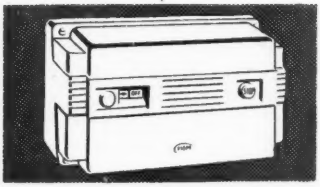

The new Auto-Memota Star-Delta starter brings you many advanced features.

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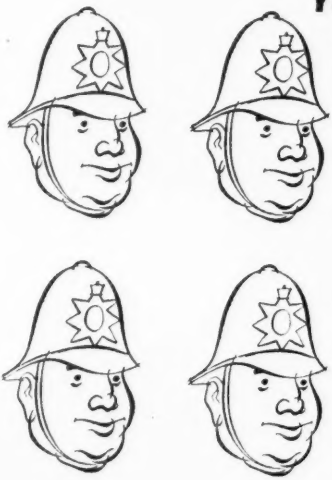
Branches in London and Manchester

You can spot the odd one out ★



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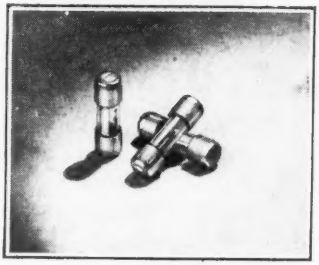
"MINIFUSE"

(U.K. PATENT 647049)



MINIATURE FUSES

IDEAL where space is a limiting factor.

A miniature fuse with a wire element only $\frac{5}{8}'' \times \frac{3}{16}''$.

The results of long development enable such a fine element to be handled in production to give reliable results from 10 mA to 50 mA.

Useful in the protection of small meters, test and laboratory gear, etc.

Ratings from 50 mA comply with R.C.L.261.1.

Fusing time with 120% overload = 1 second.

The results tabulated below are from a typical application, the protection of an 0-10 mA moving coil D.C. milliameter (50 scale divisions) using a 10 mA "Minifuse" in series.

Prospective current through Meter	Result
Greater than 1 Amp.	No movement of needle.
750 mA.	No movement of needle.
250 mA.	Movement of $\frac{1}{4}$ division.
20 mA.	Movement of 3 divisions.
15 mA.	Meter driven off scale, 50% overload, no apparent damage or change of calibration.

L562 Rating 10, 15, 25, 50, 100, 250 and 500 mA 1 and 2.5 amp

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. . . **WHEN A J. & P. "D" FUSE-SWITCH IS BLOWN**

You really can see a J. & P. "D" fuse-switch in the isolated position from a very long way off. On blowing, the tension on the catch holding the fuse-carrier is released, and the carrier swings down to give a clear indication of the source of the interruption.

Other advantages of this cheap and simple fuse that has been sold in tens of thousands all over the world, are: rewiring at ground level; use as an ordinary isolator; and single bolt fixing on most sizes. It is available for voltages up to 33 kV, and a repeater type can be provided.

Full details are given in Publication SG.51.

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They can be incorporated in all types of machinery by reason of their design and small dimensions. The following are a few of the industries to which suitable applications can be made: Textile, Dyeing, Machine Tools, Paper and Cardboard, Food Industry, Agriculture, Printing, Wire-drawing, Chemicals, Rubber, Glass, Brewing, etc.

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Crofts

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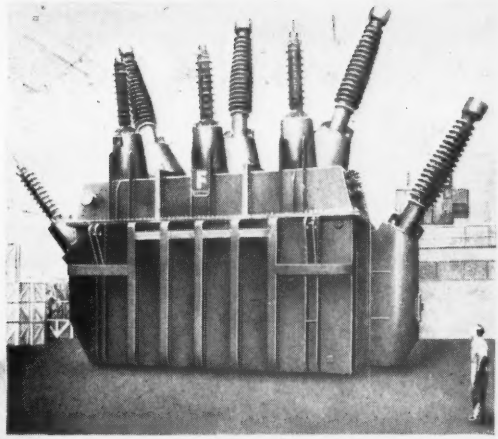
ENTRE :
e Transformer in special
nsport casing leaving the
tory at Hollinwood.

OTTOM :
e service tank is loaded
the docks.



A 230 kV, 3 - phase, 64 MVA FERRANTI TRANSFORMER LEAVES FOR SERVICE OVERSEAS

The transport limitation on this contract necessitated shipment of the core and windings of the Transformer in a special transport casing. The service tank was shipped separately.

FERRANTI

FERRANTI LTD
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London Office :
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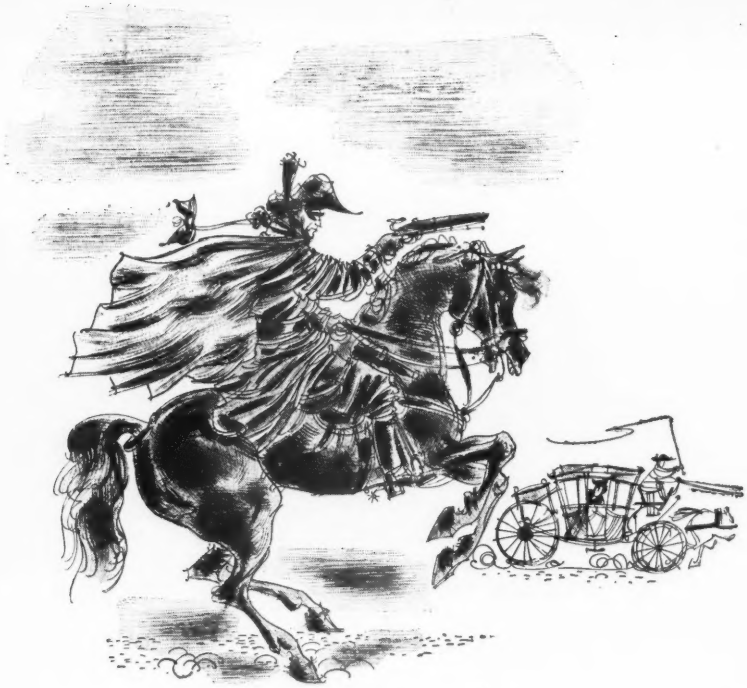

'Stand and deliver' was a demand often heard in the time of Dick Turpin, one of Enfield's less popular visitors. Hold-ups still occur here today — not the cowardly designs of highwaymen — but hold-ups in raw material supplies (amongst other things) which prevent us from making all the fires and cookers we would like in order to satisfy the ever-increasing demand.

We are doing our very best to distribute our output fairly, and hope that it won't be so long before we too will be able to ' stand and deliver ' just what you want.

you can't beat a "Belling"

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CRC369

Note these features

The unique features embodied in the construction of the 'Holborn' Frame and Cover have ensured its popularity amongst users all over the world.

1. **THE COVER SLIDES** easily into and out of the Frame.
2. **ROUNDED CORNERS** give added strength to resist breakage in transit and handling. Fig. 1.
3. **EASY TO REMOVE**—The inclined section prevents dirt and foreign matter wedging the joint. Fig. 2.
4. **NON-SLIP.** Narrow raised serrated edges, scarcely noticed in made-up pathway, minimise slipping by pedestrians.

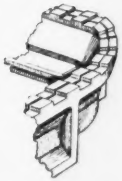

FIG. 1

5. **CORRECT POSITIONING** of cover in frame is ensured by special combined location and pinch bar slot.
6. **TESTS FOR STRENGTH.** Larger size pavement frames and covers were proven in successful weight tests of over 3 tons dead load and half a ton rolling load.

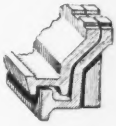

FIG. 2

7. **NAME PLATES** available. Loose cast iron plates avoid the necessity of specially cast covers.
8. **WIDE RANGE OF SIZES** to meet all normal requirements.

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"HOLBORN" PAVEMENT FRAMES AND COVERS

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(Patent applied for)

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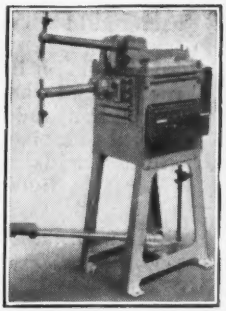

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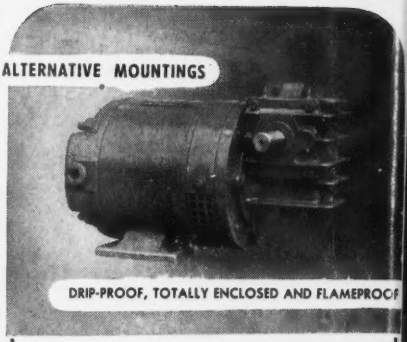

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REVIEW

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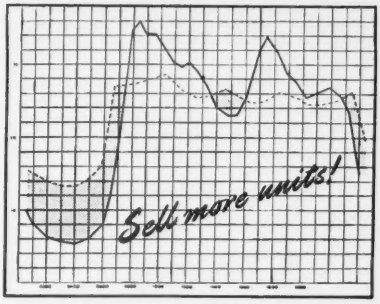
Write for further information.



Dotted line shows how non-priority load can be transferred from 'peak' to 'off-load' periods by means of Rythmatic Ripple control.

RYTHMATIC RIPPLE CONTROL EQUIPMENT

AUTOMATIC TELEPHONE & ELECTRIC CO. LTD., Strowger House, Arundel Street, London, W.C.2
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A3352-C23

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It is surprising what a difference the reduction in weight makes both when transporting and when installing aluminium sheathed cables. But then, 20% to 70% is a considerable reduction. If it is used unarmoured, as it frequently can be, the saving in weight is even greater—as is the financial saving.

British Patent Nos. 627815 *&* 627793.

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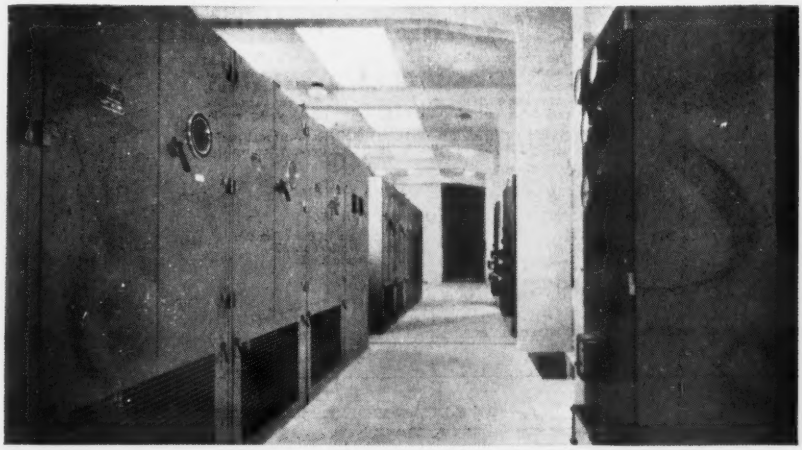
REVIEW

'ENGLISH ELECTRIC'

mercury-arc rectifiers



3,000 v. Pumpless Rectifiers in Traction Service

Electrification of the Brazilian Estrada de Ferro Santos a Jundiai was completed by 'English Electric' in 1950. Fifteen 3,000 h.p. 3,000 volts DC electric locomotives, the most powerful of their type yet built in Britain, three 3-car suburban trains, and all AC supply, transmission, signalling, converting and control equipment — including substation buildings — were supplied by the Company.

In this typical substation at Tiete, power is fed to the overhead conductors by two air-cooled, sealed steel-tank mercury-arc rectifier sets each rated 2,000 kW at 3,000 volts. Ultimate total capacity of the substations is 18,000 kW, of which 12,000 kW is installed, soon to be increased by a third 2,000 kW set at Tiete to meet increased traffic demands. This is believed to represent the first application of pumpless air-cooled steel-tank rectifiers for main line traction duty at 3,000 volts.

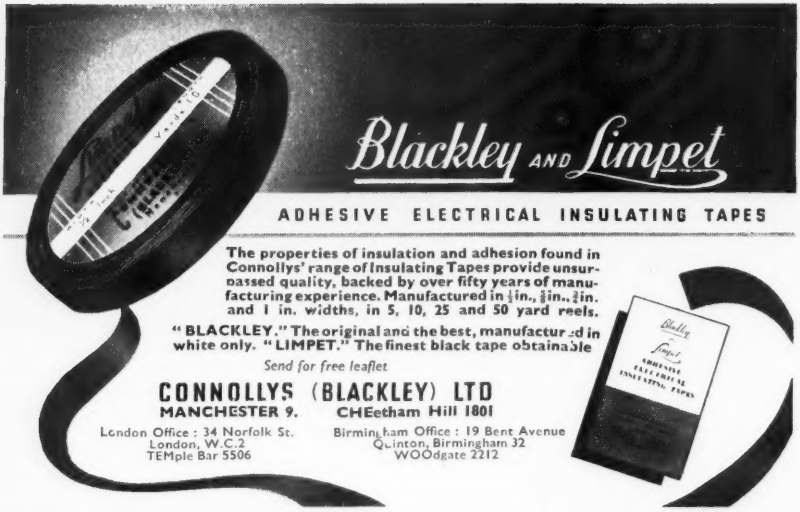
'English Electric' rectifier equipments in service range from the 36 kW unit for Istanbul University to a 27,810 kW installation for aluminium production, largest ever supplied by a British manufacturer.

The ENGLISH ELECTRIC Company Limited

QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Rectifier Substation Department : Stafford

Works: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL



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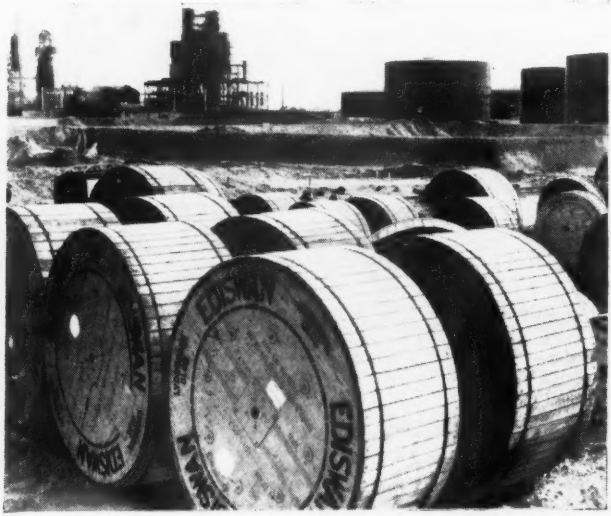

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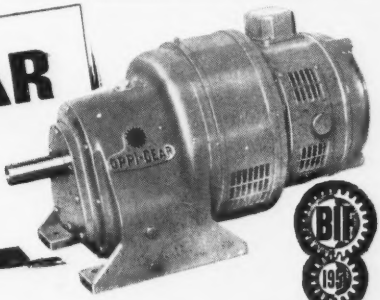

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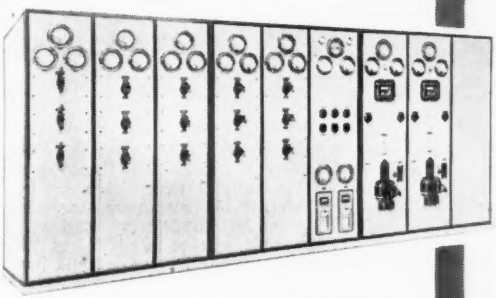

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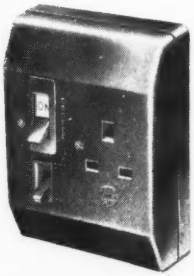

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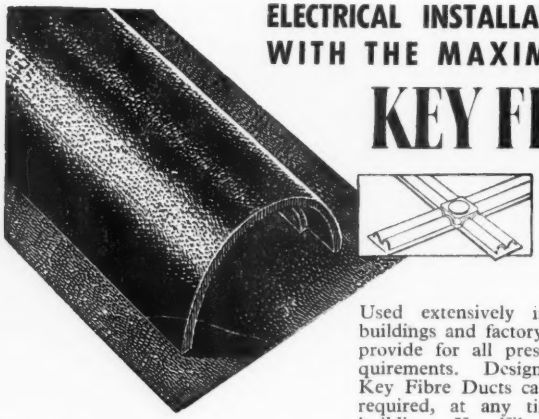

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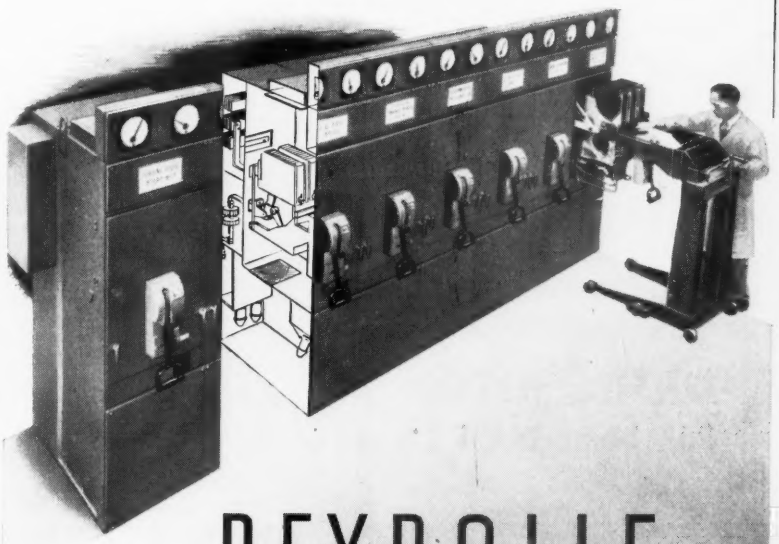

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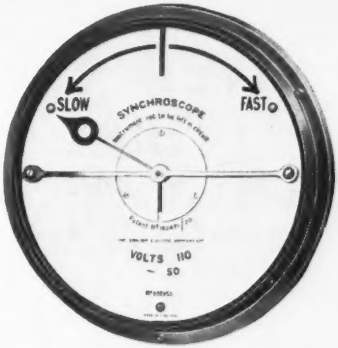

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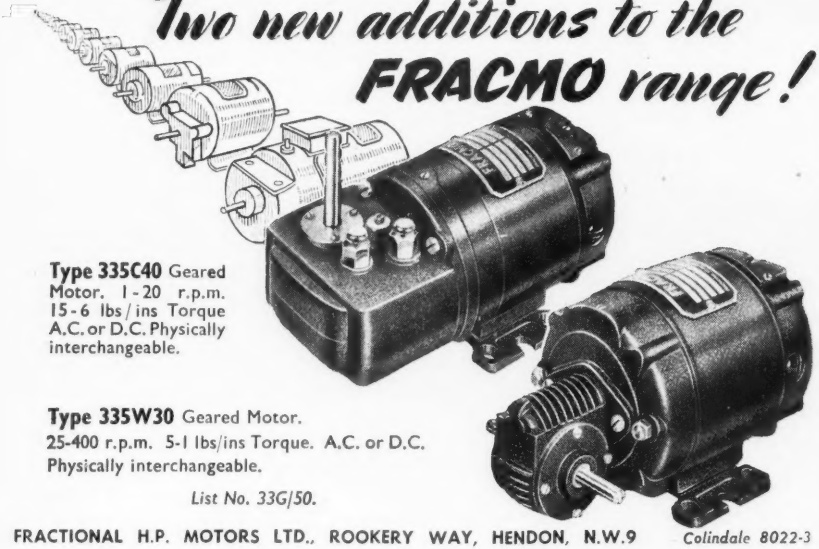

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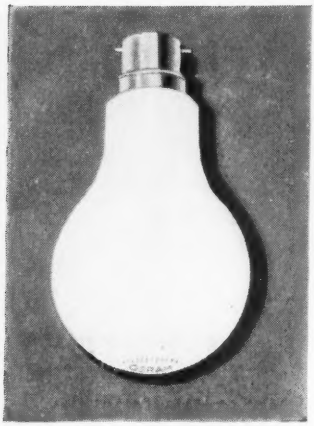

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Watts	Standard Cap.	List Price	Purchase Tax Extra	Total Price
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40	BC	1 7	0 5	2 0
60	BC	1 7	0 5	2 0
100	BC	2 0	0 7	2 7
150	BC or ES	2 9	0 8	3 5
200	ES	4 6	1 2	5 8

NOTE.—40 - 60 and 100 watt sizes have coiled coil filaments.
Standard voltages—200, 210, 220, 230, 240, 250, 260.

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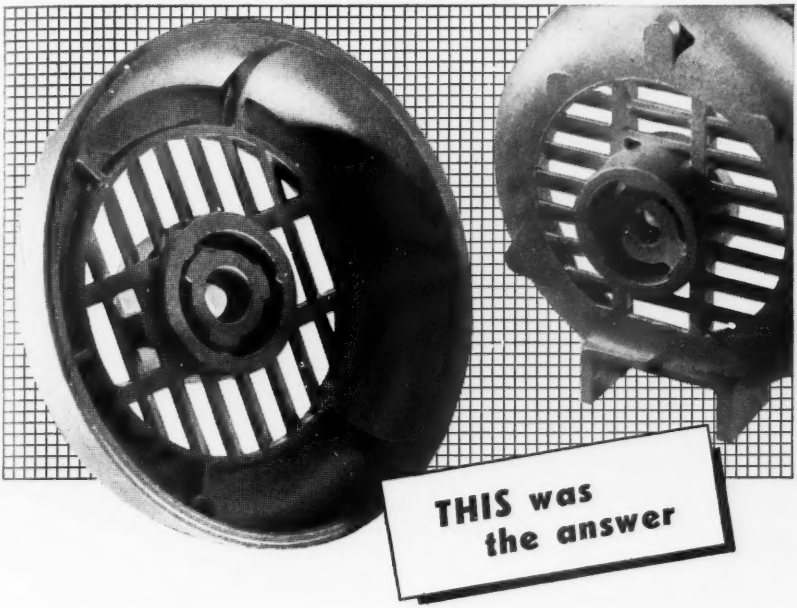

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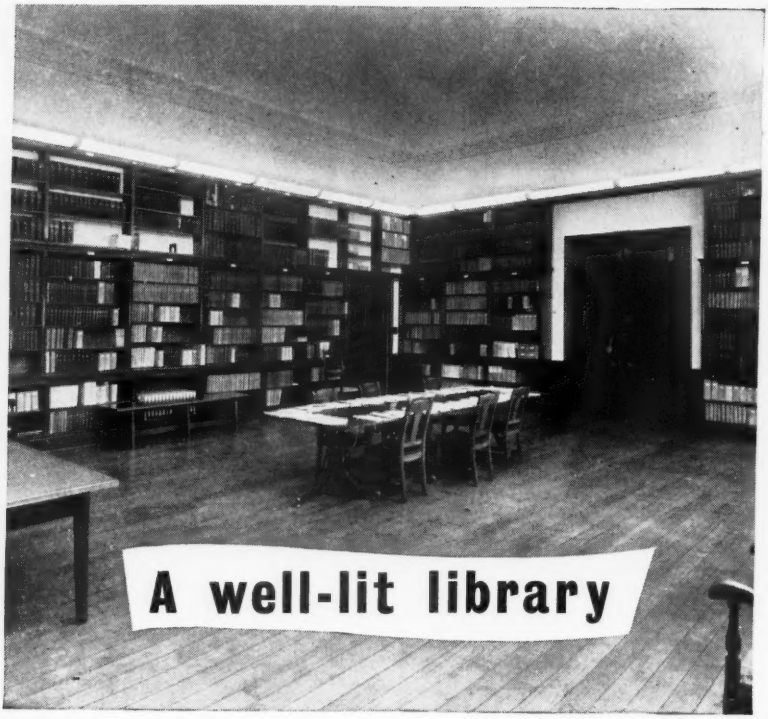

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150	1,000	Brook	S. Protected	Slip Ring
140	960	Brush	Enc. Vent.	Slip Ring
90	750	Brook	S. Protected	Slip Ring
75	740	Crom-Park.	T.E.F.C.	Slip Ring
70	1,000	Brook	S. Protected	Slip Ring
67½	1,450	E.C.C.	Enc. Vent.	Slip Ring
55	1,440	Brush	S. Protected	Slip Ring
50	465	Brush	Protected	Squirrel Cage
45	730	B.T.H.	S. Protected	Slip Ring
40	580	E.C.C.	Protected	Slip Ring
32½	1,465	Crom-Park.	T.E.F.C.	Squirrel Cage
32	1,500	Wright	Protected	Squirrel Cage
30	735	Crom-Park.	S. Protected	Squirrel Cage
27	970	B.T.H.	T.E.F.C.	Squirrel Cage
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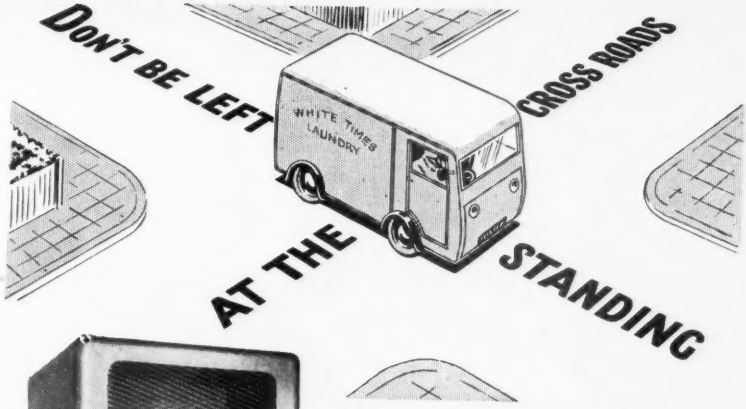

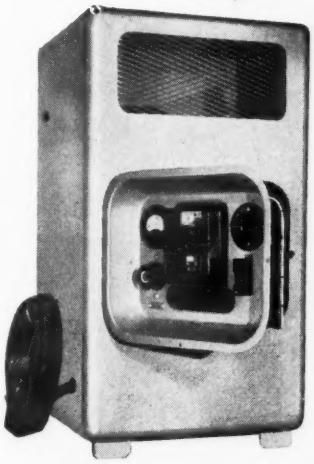

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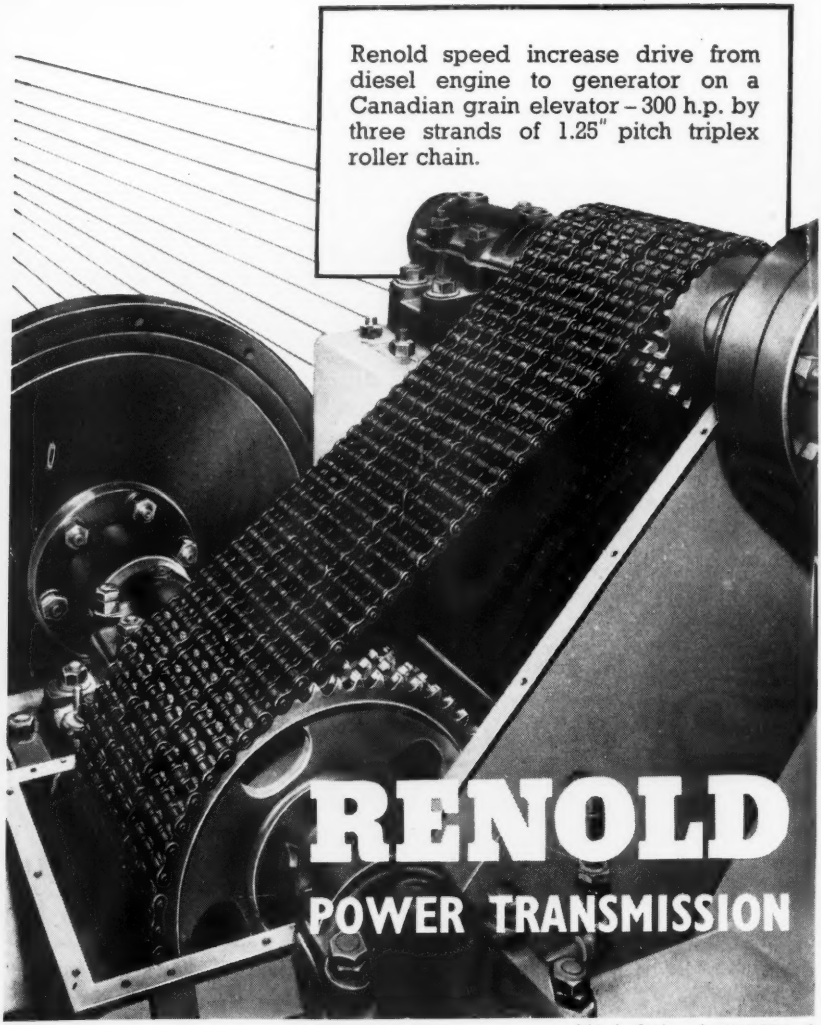
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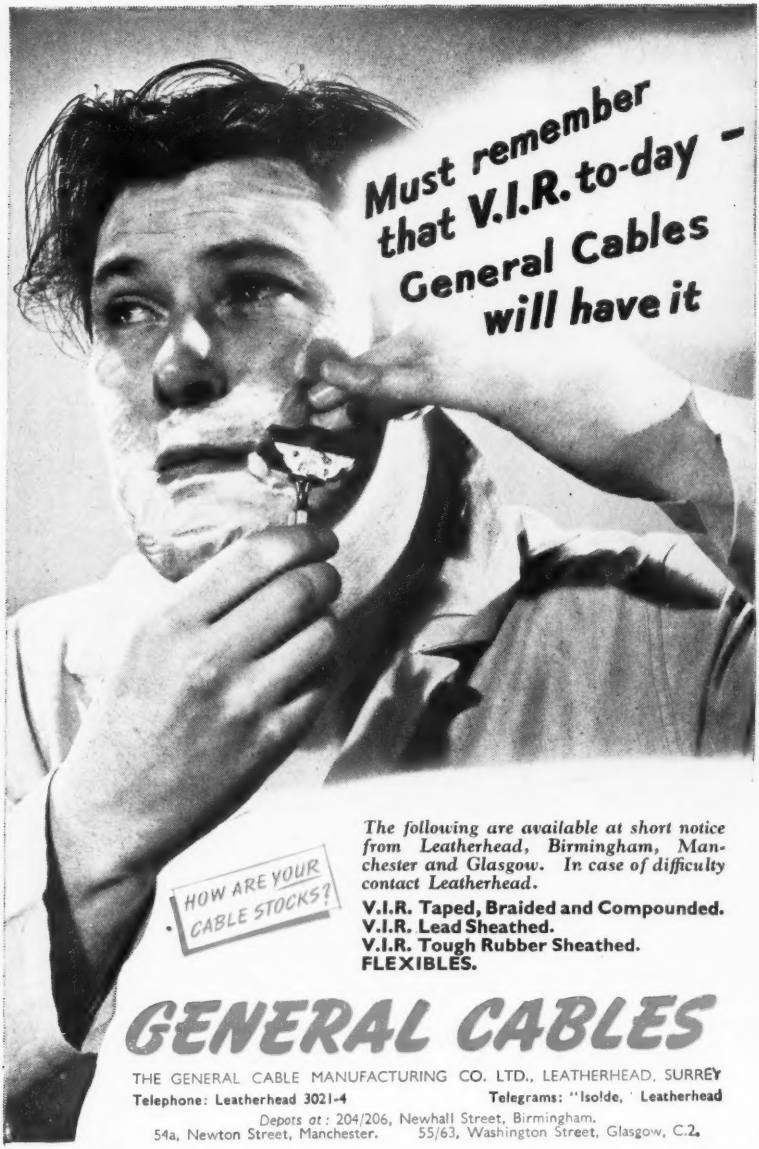

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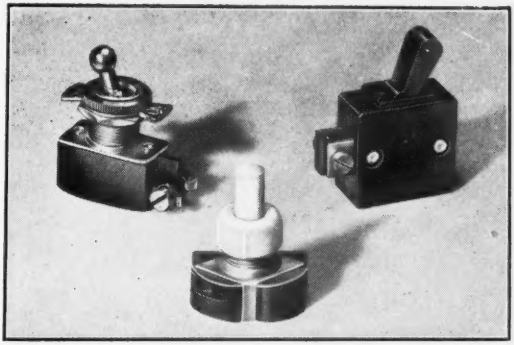

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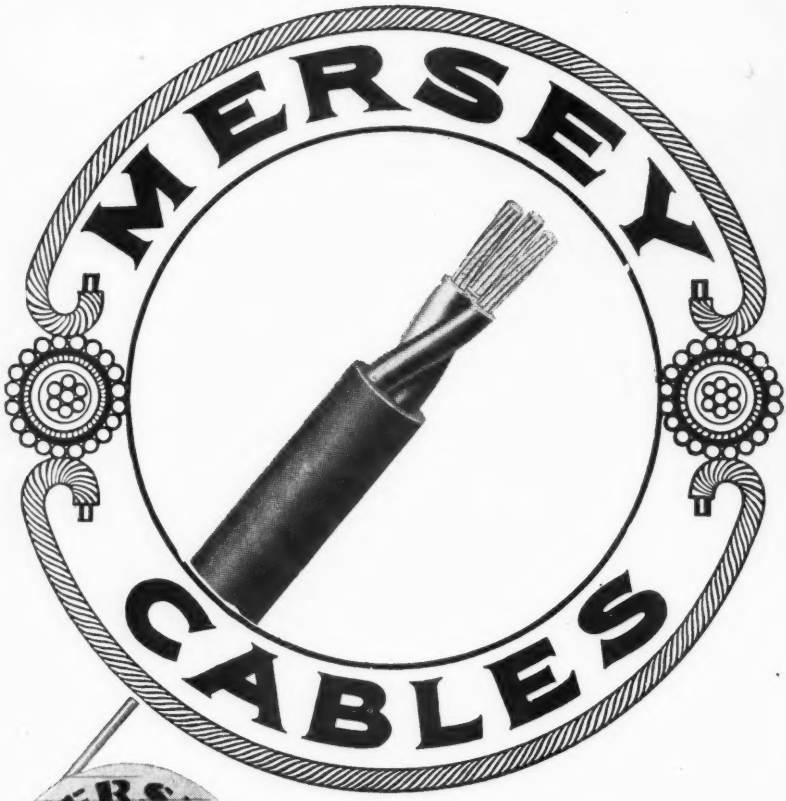

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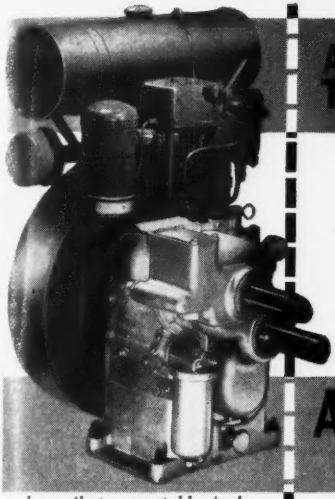

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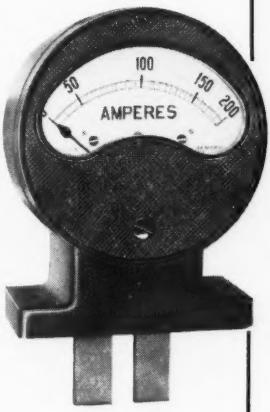

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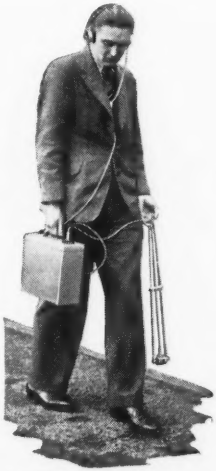

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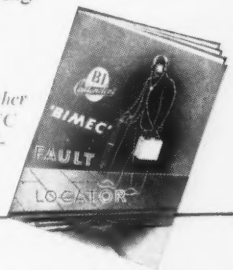

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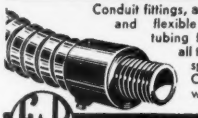

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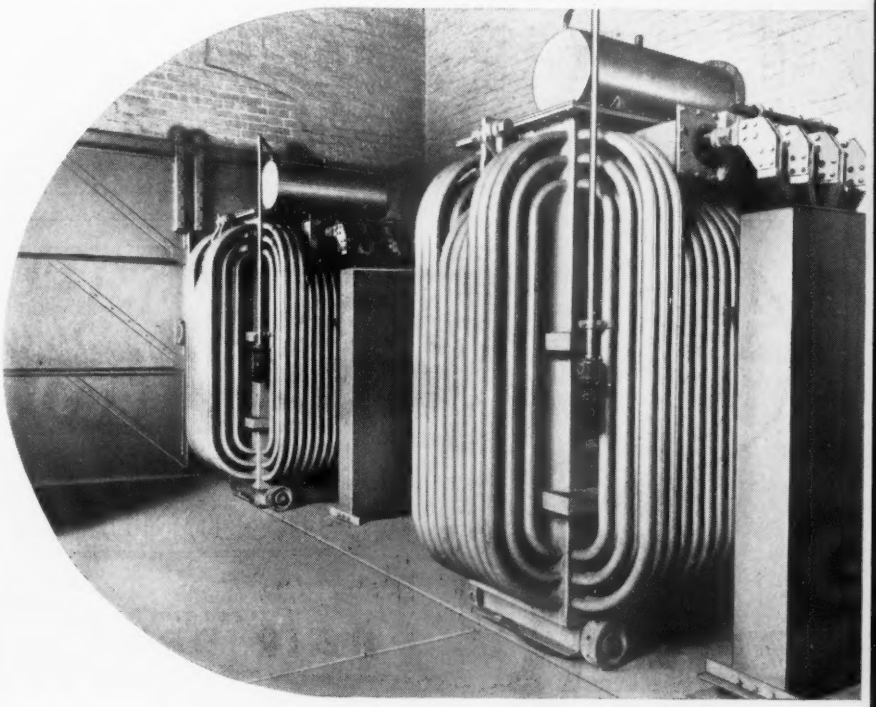

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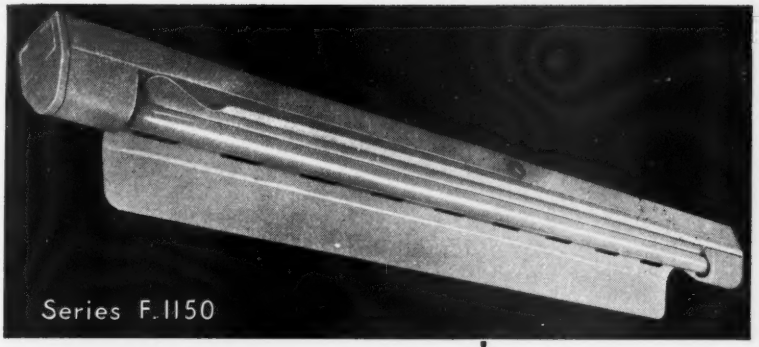

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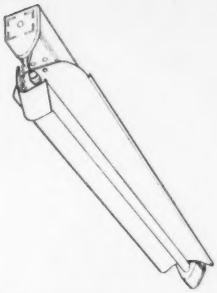
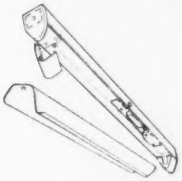


FOR IMMEDIATE access to lampholders, slide end-covers towards centre of fitting. End-covers will then drop away but will be held captive.



TO REMOVE reflector for access to lamp auxiliary gear, loosen single captive knurled screw at one end of the fitting and slide reflector out from the other.

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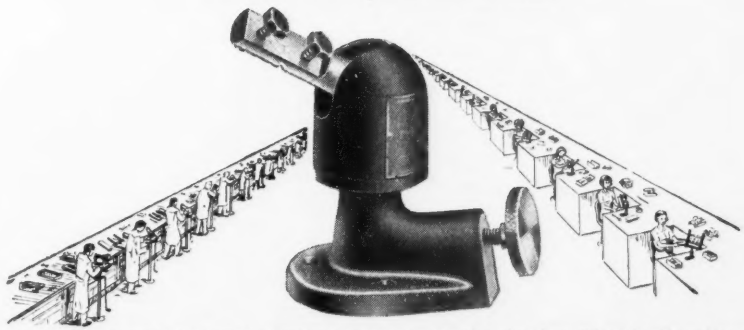

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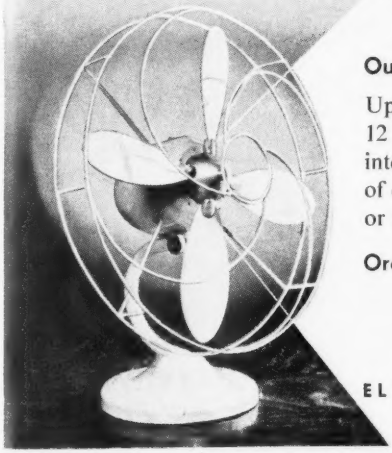

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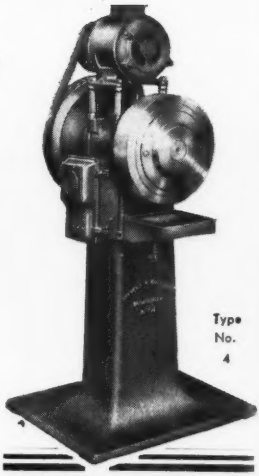

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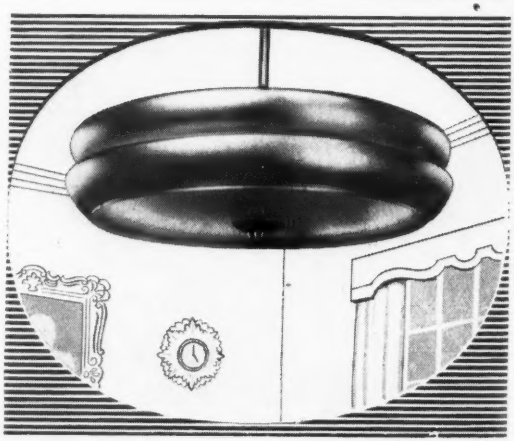

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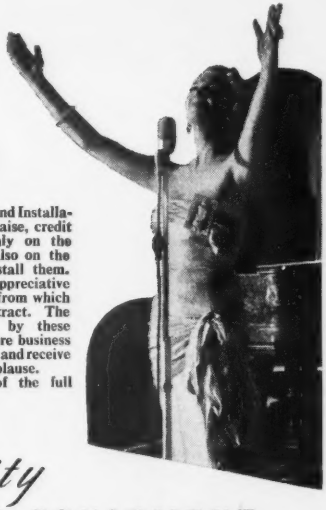

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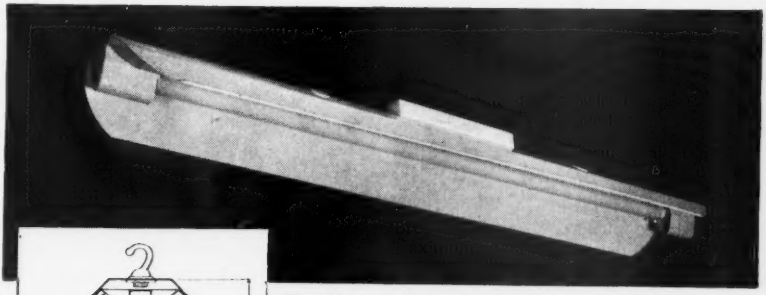

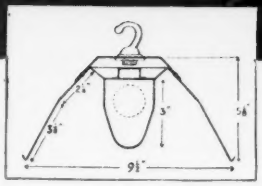

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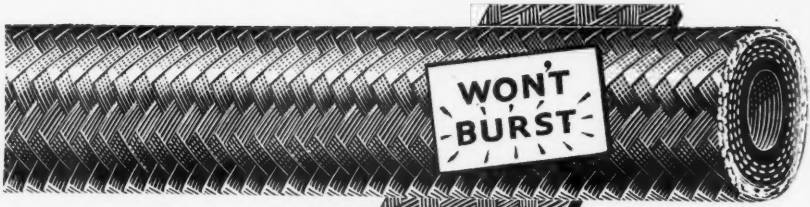

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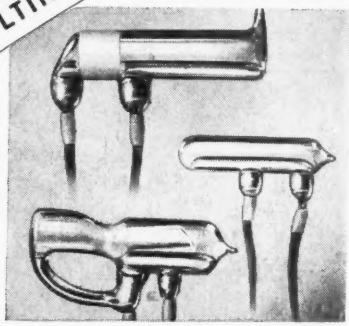

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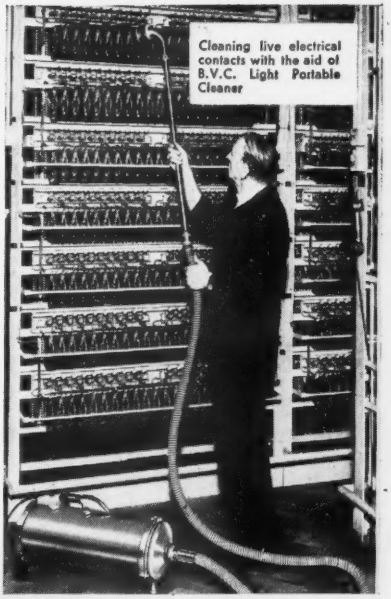

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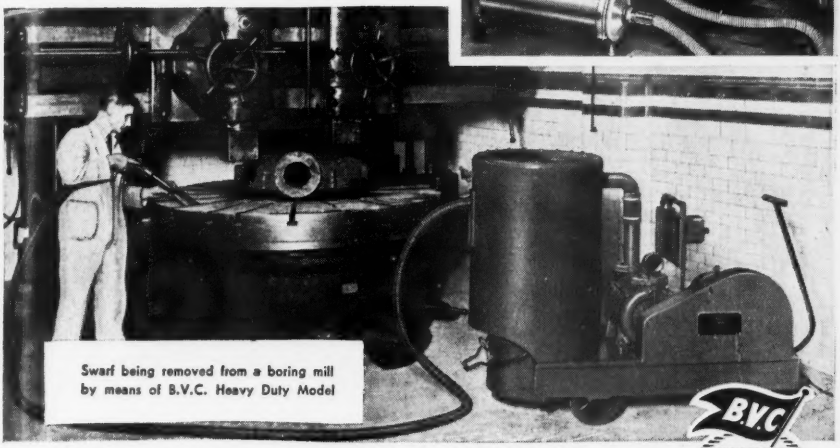

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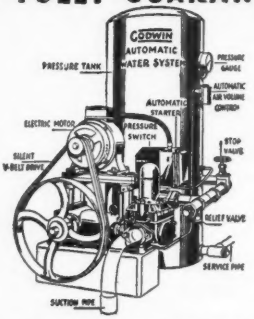

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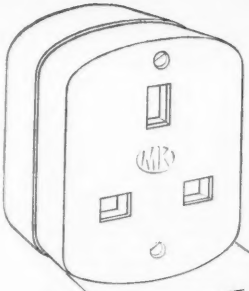

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...INDWARD AN... ...EEWARD ...S.

The King has approved the appointment of Mr. Donald Edward Jackson, puisne judge of the Windward and Leeward Islands, to be Chief Justice of the Windward and Leeward Islands, in succession to Sir Clement Malone, who has recently retired.

FUEL SHORTAGE—WARNING

Stocks of coal are dangerously low.

A serious shortage will close factories, cause unemployment and bring hardship to your home.

ACT NOW

by using less

COAL GAS ELECTRICITY

Issued by the National Coal Board, the Gas Council and British Electricity in support of the Ministry of Fuel & Power campaign

The wreckage of an aircraft was found to-day in the sea south-east of Reykjavik. It is believed to be that of a Dakota which crashed near Reykjavik last night in a blizzard. There were 20 persons on board the aircraft, which...

There was another atomic explosion to-day at the Atomic Energy Commission's testing ground in Nevada. Like the...

EVERYONE is being asked to save coal, gas and electricity and the efforts of the nation must not be wasted in the factories.

In every factory fuel must be used to the greatest effect and economies made wherever possible.

Your extra care will help to keep industry working.

Bundesrat to-...

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KEY TO A DEADLOCK

Free circulation comes to a stop when machinery pumping corrosive liquids deteriorates, as it often does, through chemical action. In this particular pump-casing, the problem was solved by the use of Tufnol, with its strong resistance to corrosion: and since only a few of them were required—the cheapness of their machining, in comparison with production costs for casings made of metal, was yet another advantage. Tufnol's combination of qualities is unique! In what other material, for instance, can you find extreme lightness in weight; good structural strength; excellent electrical insulating properties; high resistance to impact and shock; and a capacity for withstanding extremes of climate? Its field of application is immense! Whether used in the standard forms—sheets, tubes, rods, bars, angles and channels, or in shapes moulded to specification, Tufnol offers the engineer new freedom for his ideas.

An example of Tufnol rolled and moulded on to a metal centre.

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for the engineer with imagination. Every day fresh uses are being found for Tufnol: there is bound to be a way in which it could help you. Available literature shows what Tufnol has done. If you think you have a NEW use for it, let our Technical Staff help you develop your idea. Send us particulars TODAY!

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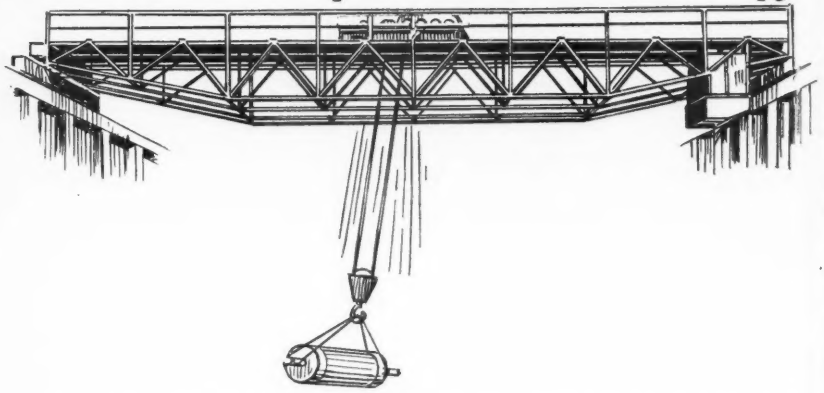
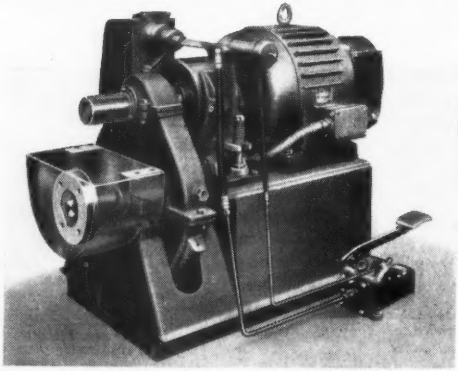
Avoid this by smooth braking!



with the NEW ELECTRO-HYDRAULIC PERIGRIP BRAKE

This photograph of a demonstration unit shows an electro-hydraulic brake with foot pedal for transmitting the working pressure to the receiver unit of the brake which gives a torque proportionate to the pedal pressure.*

**Supplied by Messrs. Exactor Ltd.*



This new electro-hydraulic brake has been developed to provide a smooth, quick, braking action on the long travel motions of overhead cranes. It is operated by bringing the controller to the "Off" position and then using the hydraulic foot pedal control, thus eliminating the load swing caused by fierce braking.

A.C.
8", 10" & 12"
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ELECTRICAL REVIEW

Vol. CXLVIII 13th APRIL, 1951 No. 3829

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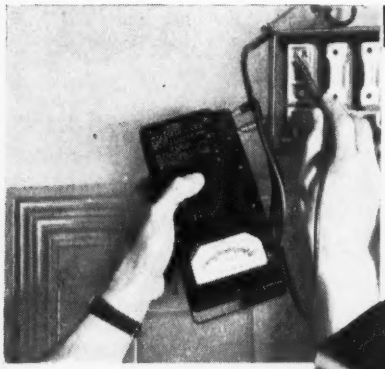

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ELECTRICAL REVIEW

Vol. CXLVIII No. 3829 13TH APRIL, 1951

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872

The State of the Nation

ECONOMIC PROSPECTS IN 1951

IN the immediate future the United Kingdom faces a decline in the national output, a worsening of the balance of payments, a fall in supplies of some consumer goods and a continuing rise in prices. "The Economic Survey for 1951" (H.M. Stationery Office, 1s) states that the problem is how to rearm as fast as possible while maintaining a strong and healthy economy. A flourishing export trade and a high level of investment at home are both essential conditions of economic strength. It is the Government's policy to shield exports and investment as far as possible and to shift the main burden on to consumption.

Control of Production

Defence orders must inevitably conflict with production of metal goods for export and investment. Where necessary formal controls and powers of direction over production will be used, including allocation of scarce materials, limitation or prohibition of less important products and the requisitioning of factory and storage space. Over half a million extra workers will be needed for defence production by 1953–54, but the actual movement of workers from one job to another or from one place to another will not be anything like as great as this might imply.

Uncertainty about quantities of certain raw materials qualifies all production forecasts. Over the past three years productivity has risen by an average of 7 per cent a year. It is assumed that this year industrial production will be about 4 per cent greater than in 1950, i.e., the level at the end of that year will be maintained.

Generation and Peak Demand

Thanks mainly to the achievement of a better balance between supplies of different types of equipment, the net increase in electricity generating capacity in 1950 was much the largest on record—amounting to 965 MW compared with the previous highest of 759 MW in 1938. In 1950 for the first time the installation of new turbo-alternators exceeded 1,000 MW. Nevertheless the plant put into service during the year was not enough to offset the growth of demand and shedding was frequent during the winter months. New construction is proceeding well and a steady increase in commissioning is therefore to be expected in 1951, but peak demand during the winter is likely to remain in excess of maximum generating capacity for some years to come.

Production of the metal-using industries in 1950 was 10 per cent higher than in the previous year but it cannot be expected to increase by anything like as much this year, when supplies of steel and non-ferrous metals are limited. One of the most difficult problems is the supply of machine tools. It is considered that these industries will be able to meet additional claims of rearmament without seriously reducing the total supplies for export and investment if their output is moderately increased and "civilian" supplies are curtailed. In the radio industry, for instance, Service demands for radio and radar equipment will limit the production of civilian radio and television sets.

By February, 1951, import prices were already about 25 per cent above the average of 1950 and some further rise is inevitable. The volume of imports is expected to increase a little more than the volume of exports—about £25 million more at 1950 prices, with the result that there will be about £50 million less available for home investment and consumption. A very small decline in personal consumption in 1951 (less than 1 per cent) is assumed but the fall will be bigger if production fails to rise by 4 per cent.

ELECTRICITY IN AIRCRAFT

The description of the electrical power equipment in the *Brabazon* aircraft which was presented in a Utilization Section paper at an ordinary meeting of the I.E.E. last week is the first of its kind which the Institution has had. Its author is also the first member of the aircraft industry to have written a paper on the subject. This prototype was, at its inception, unique in many respects; if it were to be rebuilt to-day, the electrical system would probably differ from the original, but that is the way in which engineering development usually takes place. The fact remains that the system worked and its principles have since been applied to a number of other large aircraft, the requirements of which are thus opening up fresh fields of interest for the electrical engineer.

SHARES FOR EMPLOYEES

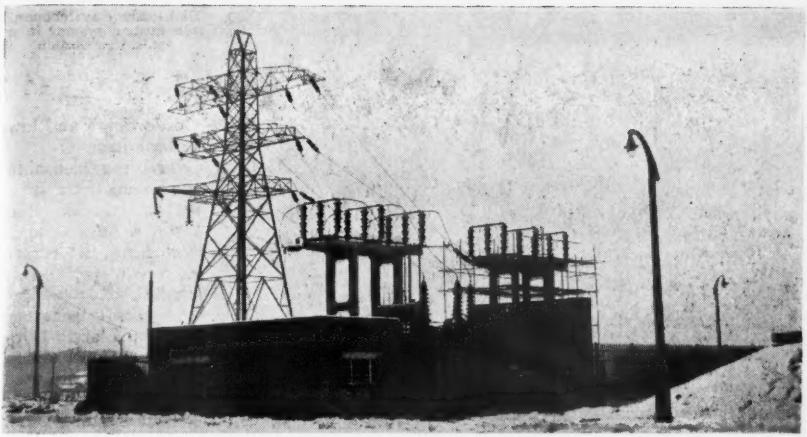
An endeavour by Associated Electrical Industries, Ltd., to give its employees a financial stake in the company has had to be abandoned. The scheme was approved by the Capital Issues Committee (which, at the same time, withheld approval from a proposal to issue 1,000,000 new ordinary shares to existing shareholders at the same price). Unfortunately the Inland Revenue authorities ruled that the allocation of shares to employees at less than the market price was in the nature of a bonus and that income tax would be payable on the difference between the issue and market prices. This may be the legal aspect but it is discouraging to companies who wish to give their workers an interest in the business in which they are engaged. They would be very dubious of selling employees shares at the market price for fear of a later decline in value, even if employees were attracted by such an offer. It would not conduce to harmony if there were a depreciation to below the amount paid for the shares.

COST OF CUTS

An idea of the cost to the country of generating plant shortage was given by the Minister of Fuel and Power at the E.A.W. Conference last week. Mr. Noel Baker's "guess" that from £8 million to £10 million worth of industrial production had been lost through load shedding illustrates indirectly the intrinsic value of electricity in application. The number of kWh lost from the same cause in 1949–50 was equivalent to 0·076 per cent of the output of the power stations, so that each such kWh may be said to have an economic value of about 5s.

CORONA RESEARCH

Investigation of the influence of weather and voltage changes on corona loss from, and radio interference caused by, e.h.v. power lines has been proceeding in the United States co-operatively between the American Gas & Electric Co. and eight manufacturers of electrical equipment. An overhead test line adjacent to Tidd power station has been energized at 500 kW continuously for the past three years. Data have thus been collected which, when correlated with local weather bureau records, will enable the annual corona loss of a contemplated power line to be determined. In weather which is foul enough to blanket the power line, corona at such high voltage may be so great as to require additional generating capacity to compensate for the line losses.



Large Wool Mills—II

Arrangements for Electricity and Other Services

IN our issue of 6th April we described the various applications of electricity to the production of knitting wools at the new factory of Patons & Baldwins, Ltd., at Darlington. It is now proposed to deal with the electricity, heating, ventilation, water and process steam services.

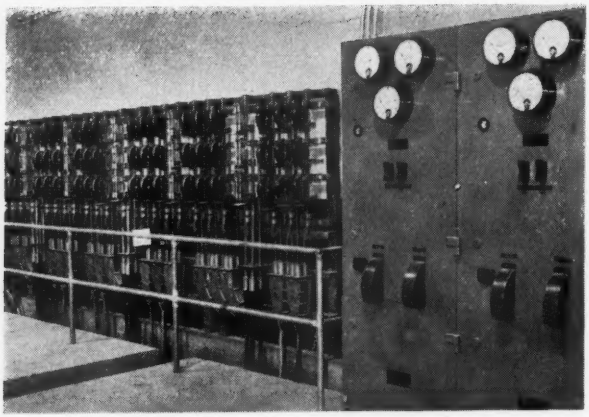
In view of the large amount of steam required for heating the building and for process work it has been found economical to produce a considerable proportion of the electricity required by means of three English Electric 1,750 kW back-pressure turbines, generating at 6,200 V. The turbines are driven at 6,000 r.p.m., David Brown speed reducers giving an alternator speed of 1,494 r.p.m. Electroflo boards indicate the steam operating conditions. Provision has been made for the installation of two further generators of similar capacity at a later date.

These generators are coupled direct to, and run in parallel with, a 6,000 V supply from the grid, a 132 kV supply being stepped down by means of two 4 MVA Reyrolle transformers. This is believed to be the only installation in the country where such arrangements for running in parallel have been made.

Supplies from the generators and from the grid are brought to a common switchboard which also covers outgoing feeders to the thirteen substations situated around the perimeter of the factory. Panels are also included for the supply to three English Electric 500 kVA 6,000/400/230 V transformers to serve the adjacent block. In the high-voltage switch room which adjoins the power house are situated two English Electric 1,600 A switches for the incoming supply, with provision for tap changing, and twenty 400 A switches for the outgoing supplies. The cables from the power house to the substations are carried in an underground service tunnel 9ft high by 12ft wide.

The equipment and layout of all the thirteen substations have been standardized.

The heading illustration shows the grid substation where the 132 kV supply is stepped down to 6,000 V for use in parallel with the factory's own supply



High-voltage switchboard and busbar system in a typical substation

In one compartment is provision for three 500 kVA 6,000/400/230 V transformers, while in the other are three h.v. and three l.v. switches (400 A capacity) arranged for manual closing, with a "Nife" trickle charger and battery for providing d.c. to actuate the tripping gear. From the l.v. switches the supply is taken to busbars whence through h.r.c. fuse links the various circuits throughout the factory are fed. A check on consumption in all departments of the factory is kept by means of meters in each substation.

The steam used for space heating, for process work and for driving the turbines comes from four Yarrow coal-fired tubular boilers, each of which is capable of evaporating 62,000 lb of water hourly into steam at 375 lb/sq in at a temperature of 700 deg F. About three-quarters of the steam generated is passed through the turbines, the exhaust steam, superheated 100 deg F, being employed at a pressure of 25 lb/sq in for space heating and process work.

Electroflo apparatus provides for the fully automatic control of the boilers, which are equipped with International chain grate stokers (3 h.p. motors), feed pumps (210 h.p.), "Sirocco" induced draught fans (100 h.p.), forced draught fans (55 h.p.), secondary air fans (19 h.p.), ash conveyors (7½ h.p.), ash skips (10 h.p.), Ingersoll Rand air compressors (12½ h.p.) for supplying compressed air to operate the regulators, extract fans (12½ h.p.), spray pumps (2 h.p.), distillate pumps (3 h.p.) and feed pumps (3 h.p.). There is a Gordon high and low water alarm.

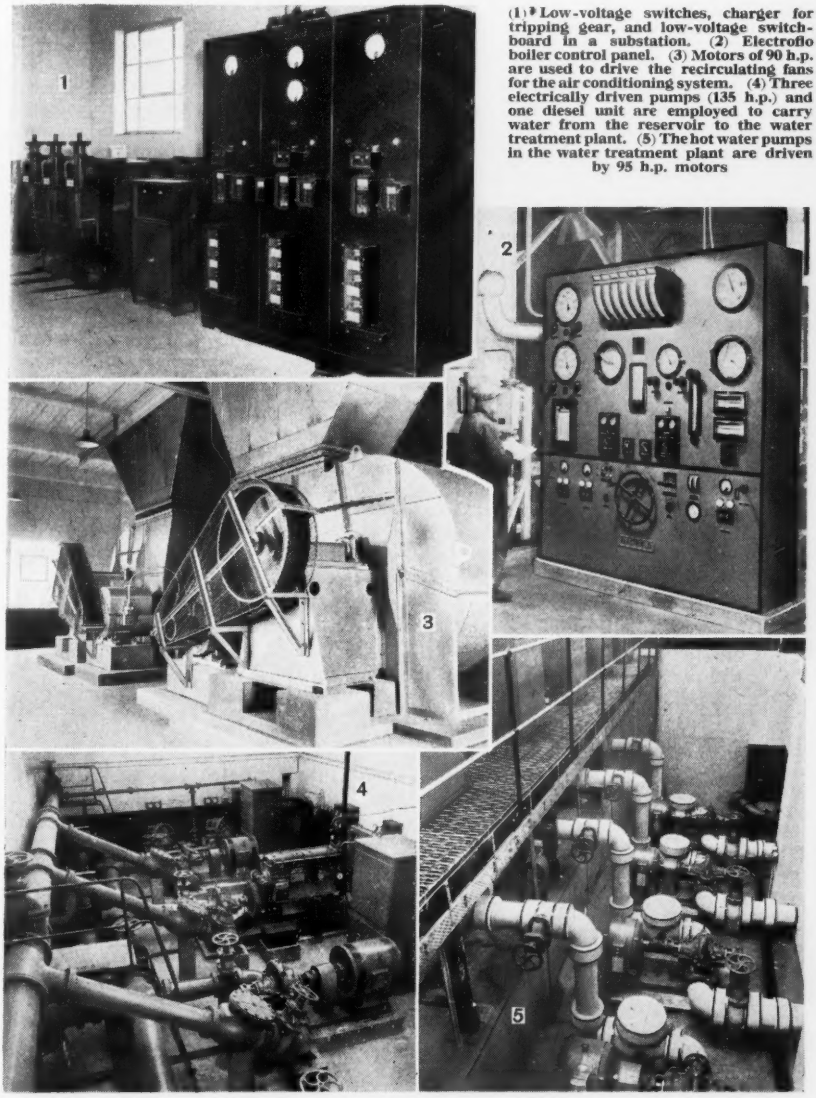
To bring the coal to the boilers there are a wagon tippler (10 h.p.), a drag scraper (60 h.p.), a bucket conveyor (10 h.p.), cross elevators (6 h.p.) and coal feeds (3 h.p.). Electro-Dynamic Construction Co.'s starters are used for the chain grate stokers and Brookhirst starters for the feed pumps, the i.d., f.d. and secondary air fans, etc. Pyrotenax mineral-insulated cable is used throughout the boiler house. "Lo-Vo-Lite" low-voltage lighting equipment is available for inspection purposes throughout the boiler house and similar situations.

It is estimated that normally 25,000 gallons of water per hour will be required for all purposes but in case of serious outbreaks of fire it is necessary to provide for a consumption of up to 60,000 gallons an hour. For this purpose a million gallon reservoir has been constructed at one end of the site. For process work including dyeing, it is necessary for the water to be softened and rendered iron free. Therefore, to take the water to the water treatment plant at the other side of the works, a pump house has been provided close to the reservoir equipped with three Gwynnes electrically driven pumps (135 h.p. English Electric motors with Allen West starters) and one emergency Davey Paxman 6-cylinder diesel driven unit, together with two auxiliary pumps.

On arrival at the water treatment plant the water is passed through the iron-free filters to the softeners. Then it goes either to the cold water storage tank or, if required heated, through a heat exchanger to a hot tank. Four 14,000 gall/hour pumps (Gwynnes) driven by 75 h.p. motors are employed for the cold water pumping and a similar number with 95 h.p. motors for the hot water supply, arrangements being made for them to operate in sequence to

meet varying demands for water. They are equipped with Allen West starters. Control panels indicate temperatures, steam pressure and pH.

In wool spinning the maintenance of the atmosphere at a uniform temperature and humidity is of the first importance. For this reason air conditioning is provided for the whole of the factory with the exception of the wool and yarn scouring and the



(1) Low-voltage switches, charger for tripping gear, and low-voltage switchboard in a substation. (2) Electroflo boiler control panel. (3) Motors of 90 h.p. are used to drive the recirculating fans for the air conditioning system. (4) Three electrically driven pumps (135 h.p.) and one diesel unit are employed to carry water from the reservoir to the water treatment plant. (5) The hot water pumps in the water treatment plant are driven by 95 h.p. motors

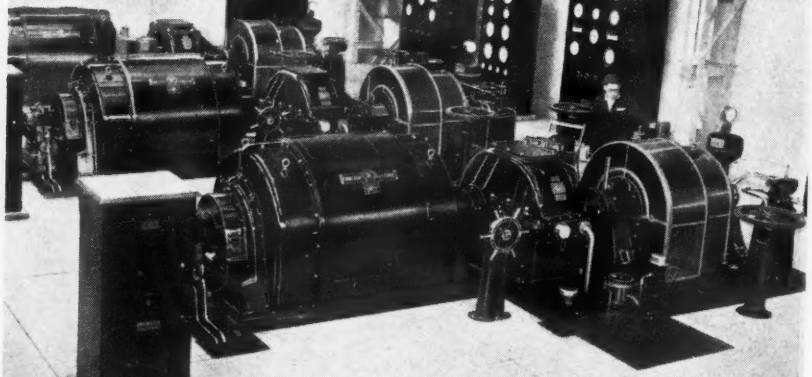
dyehouses, the former having simple fresh air plenum installations and the latter automatically controlled moisture removal plants. The system provides for five complete air changes an hour with 75 per cent recirculation of filtered air. Except in the office block there are no windows which can be opened. The air is admitted to the factory through eight miles of ducts running along the underside of the roof and is exhausted through grilles at floor level.

The air conditioning plant is installed in eight plant houses, all similarly equipped but differing in layout, some being arranged all on one floor and some on two. Each plant comprises two identical units capable together of conditioning about 250,000 cu ft of air per minute, equivalent to four air changes an hour in the factory.

Air is withdrawn from the factory through underground recirculating ducts (of which there are approximately 1¼ miles) by means of "Aerex" spiral screw fans driven by 90 h.p. motors. In the air recirculating plant the air is filtered and discharged to the mixing chamber on the floor above. It is possible by means of baffles to return to the factory or expel any desired quantity of the air received from the recirculating plant. In the mixing chamber fresh air is admitted to make up for the air extracted from the system. The mixed air is then drawn through a two-bank washer, scrubber and heater (42 h.p. motor) and finally discharged into the factory by means of 85 h.p. axial flow fans.

Operation of the air conditioning system is completely automatic, the control being designed to enable the mixture of fresh and recirculated air to be proportioned in accordance with the dew point required in the final air supply. A central control panel is provided for each plant, indicators and recorders covering steam pressure, steam flow, wet and dry bulb temperatures at twenty-four points in the factory, and also the outside air temperature. Push-button remote control is provided as well as automatic control, which achieves the desired temperature and humidity by regulating the dew point of the plant through motorized dampers fitted to each branch duct and linked to a master thermostat. The opening and shutting of the dampers by these master thermostats is arranged to admit the requisite amount of air to suit the conditions in each individual section of the factory, any rise or fall in the outside temperature being taken into consideration. Air speed and quantity are shown on a separate board (Thermocontrol Installation Co.).

Three 1,750 kW back-pressure turbines supply a substantial part of the electricity requirements of the factory



In the dyehouses humidity only is controlled; manually operated louvres direct hot air towards the vats to absorb moisture, while extract fans in the ceiling remove it. Eighteen air changes an hour are provided.

Sir Alexander Gibb & Partners acted as consulting engineers for the factory and the electrical installation was carried out by W. J. Furse & Co., Ltd. The contractors for the air conditioning and heating installation were the Andrew Machine Construction Co., Ltd., Brooks Air & Heat Systems, Ltd., and Thos. Ash & Co., Ltd. As well as the generating plant, the English Electric Co., Ltd., supplied all transformers and switchgear with the exception of the motor starters. Apart from the Brookhirst gear in the boiler house all the starters were made by Allen West & Co., Ltd. English Electric reflector fires are used for supplementary heating in the offices.

We thank Messrs. Patons & Baldwins, Ltd., for their assistance in preparing this article.

Hours and Wages

IN the March *Ministry of Labour Gazette* statistics are published of hours of working and average earnings in a number of industries at the end of October last. From these we have extracted figures relating to various branches of the electrical industry. It is to be observed that in view of the wide variations in the proportions of skilled and unskilled workers and in the opportunities for extra earnings from overtime, night work and increased output by piece-workers, the differences in average earnings shown in the table should not be taken as evidence of disparities in the rates of wages prevailing in different industries for comparable classes of workpeople employed under similar conditions. The figures for "all workers" are, of course, affected by differences in the proportions of men, women and juvenile workers employed.

The Ministry statistics for all industries covered by the returns show that the average weekly earnings of men at the end of October last were 150s 5d compared with 142s 8d a year before; of women 82s 7d (78s 9d); and all workers 128s 0d (121s 9d).

Our second table shows the number of people employed in electrical work in January last; the figures in parentheses are those for the end of 1949.

NUMBERS ENGAGED IN ELECTRICAL WORK (THOUSANDS)

Industry	Males	Females	Total
Electrical machinery ..	129·3 (124·7)	45·2 (43·6)	174·5 (168·3)
Electric wires and cables ..	40·6 (37·0)	23·3 (22·1)	63·9 (59·1)
Telegraph and telephone apparatus	29·3 (28·8)	19·1 (20·4)	48·4 (49·2)
Radio apparatus and gramophones	47·5 (40·2)	46·4 (36·6)	93·9 (76·8)
Radio valves and lamps ..	17·7 (14·7)	21·6 (18·0)	39·3 (32·7)
Batteries and accumulators	11·1 (10·9)	9·1 (8·6)	20·2 (19·5)
Other electrical goods ..	73·7 (69·0)	52·7 (46·7)	126·4 (115·7)
Electrical contracting ..	61·1 (60·1)	6·7 (6·5)	67·8 (66·6)
Electricity supply ..	163·4 (157·3)	21·6 (19·2)	185·0 (176·5)

AVERAGE HOURS WORKED AND AVERAGE EARNINGS

Industry	Number covered			Av. hours worked			Av. weekly earnings			Av. hourly earnings		
	Men	Women	All workers	Men	Women	All workers	Men	Women	All workers	Men	Women	All workers
							s. d.	s. d.	s. d.	d.	d.	d.
Electrical machinery	64,414	21,763	95,626	48·4	42·8	46·6	158 9	84 11	131 10	39·4	23·8	33·9
Electric wires & cables	22,146	11,093	35,056	49·9	42·5	47·2	155 2	79 5	126 0	37·3	22·4	32·0
Teleg. and teleph. apparatus	16,936	9,474	28,052	46·2	43·2	45·0	154 10	88 6	126 7	40·2	24·6	33·8
Radio apparatus and gramophones	18,584	18,598	39,976	49·0	44·0	46·3	161 10	86 0	119 6	39·6	23·5	31·0
Radio valves & lamps	7,815	10,652	19,873	48·0	42·6	44·8	152 0	86 9	110 7	38·0	24·4	29·6
Batteries and accumulators	5,816	2,575	8,598	48·1	44·4	46·9	169 2	86 11	142 2	42·2	23·5	36·4
Other electrical goods	32,268	17,241	51,530	47·2	42·3	45·4	160 3	86 9	127 6	40·7	24·6	33·7
Elec. wiring and contracting	21,207	294	31,189	47·9	39·7	47·1	151 11	75 10	121 1	38·1	22·9	30·8
Electricity supply	108,514	2,807	118,083	47·8	40·9	47·4	143 2	77 10	136 8	35·9	22·8	34·6

VIEWS on the NEWS

By REFLECTOR

I ONCE suggested that the deposit called for by the electricity supply authorities from new consumers was a sound investment paying more than is customary from gilt-edged securities with which such deposits can rank. It is now reported that a Newport (Mon) consumer has just had his forty-year old deposit returned to him by the South Wales Electricity Board. The original sum was £3 3s; with accumulated interest the consumer is reported to have received £7 15s 5d. Evidently only simple interest was allowed; how much better would compounding have made the repayment.

* * *

The *Birmingham Evening Despatch* says that the increase of 3d an hour given to electricians employed by private electrical contractors has caused discontent among electrical fitters employed at installation depots in the Birmingham Sub-Area of the Midlands Electricity Board. Before the increase these men were a halfpenny an hour ahead of the others; now they are 2½d behind. The trouble is that the two sets of electricians are looked after by two different Joint Industrial Councils although they are doing exactly similar work. Until they are put on level terms there will always be discontent on one side or the other.

* * *

The matter of the meter cards is still being pursued by my correspondent. He says that he has now heard from the local representative of the London Electricity Board that it has been decided to abandon consumers' meter cards because the readings are recorded in the quarterly accounts. The decision was taken " in the interests of economy and because of the general shortage of paper." It is of interest to learn that a public board is mindful of paper economy but I think that this is a false economy, having regard to the small amount of paper involved. A meter card which I had from the old London J.E.A. lasted about twelve years. My correspondent has been told that the matter is receiving further consideration and so there is still hope that this small but useful service will be resumed.

* * *

While shopkeepers are still forbidden to light their windows and thus relieve the gloom of our streets it is still possible for evening football matches to be played by floodlight. The Arsenal reserve team played Queen's Park Rangers at the Arsenal Stadium last Monday evening, following an experimental match the previous week. The *Daily Graphic* reported that permission for the match was given by the Football Association; there was no mention of the Minister of Fuel and Power.

* * *

Geo-thermal steam has for some time been utilized in Italy for the generation of electricity and the possibility of a similar development in New Zealand is being investigated. I now learn that a report has been issued in Iceland also on the use of subterranean steam. Drillings carried out at Krysuvik, a hot-spring tract about 15 miles from Hafnarfjordur, at first encountered geological difficulties, but eventually sufficient steam was obtained for a 3,000 kW plant. A series of such stations is visualized. Two systems have been under consideration, namely, the piping of steam direct to the turbine after separating the water, or piping the steam first into a boiler.

* * *

Much may be epitomised in this report of an E.C.A. branch meeting appearing in the April *Electrical Contractor*:—" Considerable thought was given to relations with the local electricity authority." This is assuredly a thought-provoking subject and I am now waiting for an account of the next meeting to learn what has resulted from this meditation.

Load Control

Automatic Frequency Sensitive Methods of Load Shedding

By E. C. LEVETT, B.A., and J. A. WILLIAMS, M.Eng., A.M.I.E.E.

THE growing importance of peak-load control is directing increasing attention to methods of controlling consumers' apparatus from a distance and, more recently, to means of warning large consumers of the immediate need to reduce load and/or of the imminence of load shedding. The various systems that have been, or are being, developed all suffer from one difficulty: warning and control may be required at a time when control engineers are completely occupied and not in a position to attend to the issue of warnings. Methods of control which are applicable to street lighting and of warning on a rota, or selected consumer, basis become too cumbersome to be effective under conditions in which load is increasing as it can in the London area at about 8 o'clock on a cold winter morning.

Advantage of Automatic System

If warnings and control were to be arranged automatically on a sufficiently large scale, not only would the former be more effective but the extent of load shedding could be reduced. The lack of balance between peak load and available generating plant capacity is likely to remain for some time to come. It is not the object of this article to discuss the economics or politics of peak-load control but, recognizing existing conditions, to suggest means of achieving it automatically.

Since the first stages of load shedding are voltage reductions, it has been suggested that voltage sensitive devices might be employed for warning and control. Unfortunately voltage variation may be unintentional and of a purely local nature so that, under varying conditions, the performance of such devices may be erratic.

In contrast, frequency is uniform throughout an entire network, its rate of change being a direct measure of the magnitude of the lack of balance between generating plant capacity and load. Consequently frequency sensitive devices would seem to show considerable promise for automatic warning and control.

Checks made on a domestic installation in the London area have shown that on a winter morning frequency may drop from 50 to 49 c/s within a few minutes between 7.45 and 8.30 a.m. If the fall is rapid load shedding may be expected at or about 48·5 c/s but when the fall is very gradual, such as on Sunday midday, a figure as low as 48 c/s has been noted without any shedding being reported. The stroboscopic method mentioned below is very sensitive, so that changes in the rate of fall may readily be seen as blocks of load are shed. These checks have been made independently of any power supply organization.

Consequently, with practice, a frequency sensitive device would enable a consumer to assess the likelihood of load shedding and, if a rota system were applied to the area, take steps to meet it and/or to reduce his demand on the public supply system. An ordinary frequency meter will supply the information, but a more striking presentation of the system conditions can be obtained with the aid of a gramophone motor, a neon lamp and a circular cake tin. An outline of the apparatus appears in the Appendix.

Although of simple construction, the stroboscopic method has been described in detail because it provided the information on which subsequent work was carried out.

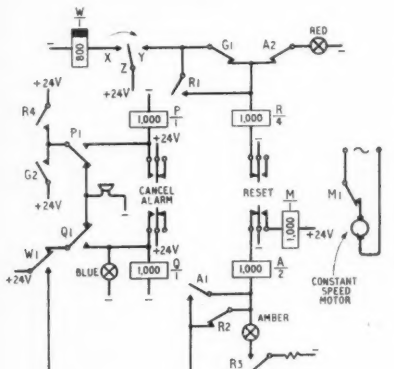
Control Methods

Simple methods of control readily come to mind. A contact might be arranged to operate under the influence of the pointer of a frequency meter, but in order to get satisfactory contact pressure a slave arm would be necessary. A governor on the spindle of a synchronous motor might be arranged to operate a contact either directly by the movement of the arms, in which case some form of power amplification would be necessary, or on the " hit

or miss" principle when the energy of rotation might be used to operate a power contact. In the governor method, as with all direct methods, however, the percentage change looked for is small.

The answer to the problem seems to be in arranging a device to discount the large constant component of frequency and take account only of variations. This is what happens in the stroboscopic method; the gramophone motor subtracts a large constant component from the mains frequency and presents the difference in visual form. Half-hearted attempts to use a light-sensitive cell were not promising, but other approaches led to the conclusion that the differential method would provide a satisfactory means of effecting frequency-actuated control.

The simplest mechanical method appears to be to mount self-starting constant speed and synchronous motors with spindles in line, the spindle speeds being equal at a selected frequency of, say, 49 c/s. Arms mounted on the spindles can be arranged to keep a contact closed while the frequency is above that selected and open it when the speed of the synchronous falls below that of the constant speed motor. Conversely, a contact can be arranged to close when the frequency falls and operate a contactor, or ring a bell. A refinement would be to use a differential gear train between the spindles and employ semi-fixed contacts. Except when there is relative movement between the contacts, the two arms are constrained to rotate at the same speed. Consequently, a slipping clutch must be employed, or the motors designed accordingly.



X and Y on synchronous arm; Z on constant speed arm; EK closes after predetermined period when T is released; LK closes after further predetermined period; operation of T opens contacts

Fig. 1.—Circuit for selective warning of frequency variation

A simple non-mechanical device might consist of a stable oscillator set at a predetermined frequency near 50 c/s and connected to the control grid of a gas-filled relay energized from the supply mains, or of a thermionic valve having a large mains frequency component in its anode or screen input. The resulting difference frequency is a much easier quantity to handle than a 2 per cent change in 50 c/s.

The two-motor method is applicable in several forms, involving simple mechanisms, and is positive in action. For every tenth of a cycle below the predetermined critical figure, the relative speed of the motor spindles is of the order of 499 : 500 so that if the contact arms are one inch long and the basic speed 60 r.p.m. (1 rev/sec) the contacts move relatively at the rate of 0·013 in/sec. Differential gearing gives a relative speed of 0·006 in/sec with contacts at the same radius.

For warning purposes such a speed of relative contact movement should be adequate, but if light motors and mechanisms are to be used a simple contactor may be necessary to control space or water heating loads. As an alternative, however, differential gearing may be employed to operate a micro-gap switch through a light toggle mechanism, or a mercury switch.

If devices of this nature came into general use, a condition might arise in which "hunting" would occur, due to a large block of load being switched at a predetermined frequency. This risk could be eliminated by staggering the predetermined frequencies at which the devices "operate" (giving the lowest to high priority consumers) and incorporating a time delay mechanism to keep the load disconnected for a pre-selected period following the operation of the control device.

If the operation of this mechanism were dependent on the power supply, in the event of a power cut the apparatus with which it is associated would remain disconnected for the pre-selected period after restoration of the supply. For water

heating loads this time delay would be an advantage rather than a defect from the control engineer's point of view.

An extension of the mechanical method is to place the contact arm mounted on one spindle between two contacts mounted on the other spindle, so that above the predetermined frequency one contact remains closed but below it the contact arm moves across to break the first contact and, after a period, make the other. The time taken in transit is a measure of the average rate of fall of frequency and can be used for indication or control.

As an example of the former a stop-watch can be started when the first contact breaks and stopped when the second makes. If the dial were divided into sections, unskilled personnel would be enabled to give warnings based on the rate of fall of frequency. Alternatively, by including a timing mechanism driven from the constant speed motor (to provide contacts which close after predetermined intervals) warning lamps may be operated; a suitable relay circuit for this purpose is shown diagramatically in Fig. 1. As an example of control, the warning lamps could be replaced by contactors to facilitate selective control of individual machines or other loads.

Several methods of obtaining a difference frequency may be visualized. The thermionic method has been mentioned. Another might take the form of a switch, operated by a cam mounted on the spindle of a constant speed motor, to "gate" pulses obtained directly or by frequency division from the mains. One theoretical method of obtaining frequency and rate of change is shown in Fig. 2, but the constants involved are rather large.

It would be possible to fill many pages with descriptions of proposed methods, but enough has been said to show that frequency sensitive devices can be made to give satisfactory performance. They need be no more complex in construction than apparatus at present used for load control and need not be expensive to manufacture.

It is contended that frequency operated automatic warning and control are basically sound mechanically, electrically, financially and, with suitable precautions, could be used on a large scale to accelerate the solution of the problem of plant shortage recorded in the second annual report of the B.E.A. Questions of legislation, or tariff incentives, may profitably be discussed while technical ways and means are being finally settled.

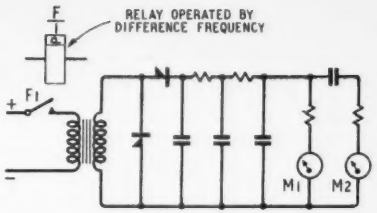


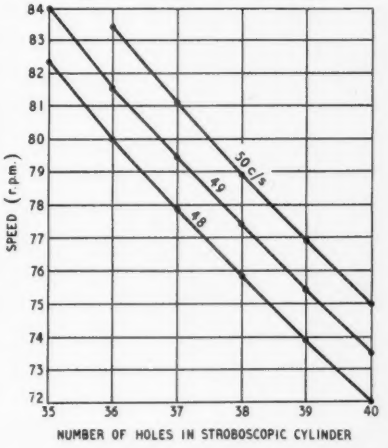
Fig. 2.—Frequency measuring circuit, M_1 indicates frequency and M_2 rate of change

APPENDIX

A number of equally spaced holes should be drilled round the edge of the tin, which is placed concentrically on the turntable. The neon lamp is placed inside and energized from the supply mains. At the chosen rates of mains frequency and turntable speed the holes will appear stationary. Above this frequency they will appear to move to the right and below it to the left, the number of holes appearing to pass a given place in a second being a measure of the difference between the actual and reference frequencies. A refinement is to eliminate half the flashes from the neon lamp with a half-wave rectifier, a swamping resistance being wired in parallel with the lamp.

A simplification is to use a circular piece

Fig. 3.—Reference frequency graph



of card with painted segments instead of the tin, but the indication then given will not be so vividly presented.

The gramophone motor speed should be reasonably independent of voltage or frequency; a Garrard shaded pole type has been found quite satisfactory as undoubtedly would other governor controlled induction motors. A spring motor is not satisfactory due to the need for winding and the inaccurate indication given when the spring is running down.

Relevant information for choice of reference frequency is given by the curves (Fig. 3) and the formula with tabulated data.

If N = number of holes
R = r.p.m. of turntable
F = frequency at which holes appear stationary
f = difference between F and actual mains frequency
T = time in seconds for image of hole to move one space when neon lamp is supplied directly from the mains
T′ = time in seconds for image of hole to move one space when input to neon lamp is rectified to eliminate alternate half cycles:

$$\text{Then } R = \frac{60F}{N}$$

$$f = \frac{1}{2T} \text{ or } f = \frac{1}{T} \text{ (approximately)}$$

F	50	49·5	49	48·5	48	c/s
N	40	—	35	—	36	simple numbers
R	75	—	84	—	80	
N	40	40	40	40	40	number of holes constant; 37 and 38 holes give turntable speeds nearest designed speed
R	75	74½	73½	72½	72	
N	37	37	37	37	37	
R	81·08	80·27	79·46	78·65	77·84	
N	38	38	38	38	38	
R	78·95	78·16	77·37	76·58	75·79	

Activities in Penang

SINCE 1939 sales of electricity in George Town (Penang) have risen from 12·6 million kWh to 21·1 million kWh (1949). At the same time the cost of oil to the Municipal Electricity Department has increased from $161,550 to $899,933, or from 1·28 to 4·257 cents per kWh sold. These figures are given in the report, received from the electrical engineer and transport manager (Mr. S. Mortimer), on the 45th year's working of the Department, which resulted in a net profit of $390,459. The overall cost per kWh sold in 1949 was 13·523 cents. During the year 18,258 installations were connected, representing 17,334 kW.

The report of the Transport Department refers to progress in the rehabilitation of the trolley-buses, of which 35 were in commission. Owing to the restricted output of the Prai station it was not possible to restart the running of trolley-buses during the evening peak-load period. Of the fleet of 16 motor-buses eight were sold during the year and two were written off because of damage, leaving six in operation. Passengers carried by the Department's vehicles numbered 7·3 million and there was a revenue surplus of $60,546 before allowing for a debit balance brought forward of $12,240 and appropriations of $72,782.

Street Lighting Improvements

AN installation of 78 G.E.C. "Viatron" lanterns with "Osram" 400 W high pressure mercury vapour lamps, covering over a mile of double carriageway on the Southend arterial road at HORNCHURCH, Essex, was switched on by Councillor Lagden, chairman of the Hornchurch U.D.C. Highways Committee, recently. The lanterns are mounted on Concrete Utilities columns, with a height and spacing to give illumination conforming with Ministry of Transport requirements for main road lighting.

Seventy Metrovick "S.O. Fifty" lanterns fitted with 140 W sodium discharge lamps are used in a new installation on the Great North Road on the outskirts of NEWCASTLE-ON-TYNE. These units are fixed to the existing trolley-bus poles spaced 111ft apart with an outreach of 3ft 6in. For reasons of economy and to reduce to a minimum the number of standards along a roadway many authorities make use of the existing trolley-bus poles. "S.O. Fifty" lanterns have proved most suitable for these applications where severe vibration and shock are always encountered. In this installation, despite the exceptional width of 45ft to accommodate a double carriageway and two trolley-bus tracks, there is a general high standard of road brightness with clear definition of the kerb line.

On the recommendation of the borough engineer, WEST HARTLEPOOL Works Committee has decided to complete the centralized street lighting control system in the a.c. area of the borough. The work entails the installation of another 21 panels costing about £6,000. The new system of control is expected to save about £600 per annum.

The Ministry of Transport has approved the spending of £6,750 by the BOLDON (Co. Durham) Urban Council on the installation of improved street lighting in Hedworth Lane and North Lane and in various unclassified residential streets.

BLACKPOOL Highways Committee has approved a scheme for improving the lighting of several roads, with conversion from gas to electricity where necessary. The total estimated cost, using m.v. lanterns, is £36,000 and the annual saving in maintenance £3,680.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Non-Combustible Oils

I REFER to the interesting article on this subject in your current issue and would like the writer to give a little further information. I investigated the use of chlorinated di-phenyl about 1933 in view of the desire in some generating stations to avoid house transformers containing ordinary oil, but was informed by the chief chemist of a large manufacturing company that the proposed liquid had the disadvantage that electrical discharge produced hydrochloric acid. In the rare event of a transformer breakdown this might involve scrapping the windings, which might not be necessary, depending on the degree of breakdown, with oil-filled types. Also that the U.S.A. transformer makers largely used the new liquid for small transformers which on breakdown in that country it is customary to throw away and replace by complete new units.

In 1944–5 I further inquired into the possibility of obtaining chlorinated diphenyl for experiments with capacitors—it was not actually obtainable then—but I was informed that the use of such liquid involved risk to the health of white workpeople, due (from recollection) to an effect on their kidneys.

I have no prejudice in these matters, but write only to request information as to whether the above is correct and, if so, whether there are means of safeguarding the well-being of manual workers using these liquids.

Banstead, Surrey. WILLIAM C. KENNETT.

THERE appears to be a discrepancy in the article on this subject, on page 699, 6th April issue. It is stated " . . . even when decomposed by electric arcing within the liquid they do not give off inflammable vapours, but only non-explosive non-toxic gases." However on page 700 it is stated:—" When an electric arc occurs in these oils decomposition occurs; the products are finely divided carbon and certain gaseous compounds which consist predominantly of anhydrous hydrochloric acid, a small amount of oxygen, carbon dioxide, carbon monoxide and certain inert gases."

Although the absorption of the hydrogen chloride is dealt with, no further mention of the carbon monoxide is made. Now since this gas is highly poisonous, I do not think the danger from it should be lightly dismissed. Any quantity in excess of 5 volumes in 10,000 of air must be regarded as dangerous; at 8 vols. in 10,000 a person loses consciousness on slight exertion (*Hutchinsons Technical and Scientific Encyclopaedia*).

Carbon monoxide can also give rise to violent explosions when ignited in air in suitable proportions, although the latter danger may be nullified by the carbon dioxide released at the same time. It is well known that the monoxide is absorbed by an ammoniacal solution of cuprous-chloride, but it would not appear to be practicable to incorporate a vessel containing this solution in the apparatus.

Later on in the article it is stated that " American reports on the subject indicate that the vapours may be toxic " and " maintenance should be carried out in well ventilated buildings," so presumably the Americans are well aware of this potential danger.

In spite of these drawbacks these chlorinated synthetic oils have an undoubted advantage over ordinary mineral oils as regards fire risk.

Carlisle. J. F. PERRIN.

Electricity and Gas

FOR many years the electricity industry has published figures of its efficiency on a national basis. Similar statistics have been lacking for the gas industry. Figures now published by the National Gas Board should, however, allow of comparison between the two industries.

There appears to be no unanimity as to whether the thermal efficiency of gas making should be computed from the heat in the gas alone or from the heat in its by-products in addition. The chief purpose of that industry is the manufacture of gas.

The amount of gas obtained from coal will be that of the volatile matter present, which may be, say, 35 per cent of the weight of the coal. Some of the volatile matter will come down as tar.

From the published figures of the Coal Board, taking the therms of gas sold, and assuming the calorific value of coal "as received" to be at 12,000 B.Th.U./lb, the heat liberated as gas is 31·4 per cent whereas the highest thermal efficiency of generating stations is between 28 and 29 per cent.

Since gas liberates its heat by combustion, its utilization efficiency is low. Gas for lighting is wasteful. An incandescent mantle consumes each hour about 5 cu ft of gas at 450 B.Th.U./cu ft. This represents a heat input of roughly 2,500 B.Th.U./hr. A 100 W tungsten lamp has a heat input of 341 B.Th.U./hr and a 5ft fluorescent lamp about 267.

The efficiency of utilization of a gas cooker has been variously given as 50 to 60 per cent. At the lower figure, the heat liberated is therefore only $50/100 \times 31{\cdot}4 = 15{\cdot}7$ per cent of that in the original coal. A gas grill has a utilization efficiency of roughly 15 per cent, so the heat given is only 4·71 per cent.

By-product coke represents about 11 cwt per ton of the coal, and, with the sale of tar, brought in £52·36 million. Gas itself brought in £111 million. The revenue from by-products is roughly half that from the sale of gas, which is obviously subsidized by the sale of its by-products. Coal carbonized is given as 25·26 million tons for the year which at 50s per ton costs £63·15 million. Thus the cost of fuel is practically covered by the sale of the by-products.

The chief cause of low efficiency in electricity generation is the rejection of heat to the condenser. In gas making probably about 80 per cent of the heat in the coal can be used, first as gas and, secondly, as by-product coke and by the recovery of tar. Owing to scarcity of coal, by-product coke is more easily disposed of than it was and does not involve the high capital costs necessary for district heating from the waste heat in electricity generation.

With district heating, 41·479 million kWh sold represents the heat value of 1,400 million therms per annum. If the condenser heat loss is 50 per cent, it amounts to approximately 35×10^8 therms per annum. If only 33 per cent of this were made use of, some 10×10^8 therms could be sold. The average cost of gas is about 1s a therm and, using the same cost value, the 10×10^8 therms would bring in £50 million by the sale of by-products.

The revenue of £50 million from the sale of heat by electric power stations would be offset slightly by the higher steam consumption with extraction working, but its utilization efficiency should, on the whole, be higher than that of gas-using appliances.

C. FIELDING, B.Sc.Tech.,
Dalmuir, Glasgow. A.M.I.Mech.E.

Sales Management Conference

THE E.D.A. Sales Management Conference, which will be held from 22nd to 25th May, will be opened by Mr. H. J. Randall, C.B.E., chairman of the London Electricity Board, and some 500 delegates from all parts of the United Kingdom are expected to attend. The first three days will be conducted in the Caxton Hall, Westminster, but the concluding sessions and conference luncheon on 25th May will take place in the Connaught Rooms, Great Queen Street, London.

The first paper, on "Electricity and the Food Trade," will be given by Mr. H. T. Perry, chief sanitary inspector, Kingston-on-Thames. In the afternoon Mr. Philip Honey, of E.D.A., will speak on "Co-operation with Allied Professional, Trade and Other Organizations" and in the evening a programme of E.D.A. films will be provided. On Wednesday morning Mr. W. Robinson, E.D.A., will read a paper on "Lighting Opportunities" and in the afternoon Professor H. A. Robinson, director of the School of Agriculture at Nottingham University and vice-chairman of the E.D.A. Rural Electrification Advisory Committee, will deal with the subject of "Agriculture, Education and Electricity." At 5.30 p.m. Mr. A. Duxbury, of the Duxbury Institute, will give a short talk on "Public Speaking." At the first session on Thursday Mr. L. Landon Goodman, E.D.A., will deal with "More Mechanical Handling as an Aid to Greater Productivity" and in the afternoon Mr. R. Smith, of the G.E.C. Wembley Laboratories, will read a paper on "Radio Frequency Heating." Delegates will assemble at the Connaught Rooms on Friday morning for a general discussion on electrical topics followed by the conference luncheon.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AT the annual meeting of the Institute of Marine Engineers held on 2nd April, **Mr. S. F. Dorey**, C.B.E., F.R.S., D.Sc., Wh.Ex., was elected president for the ensuing year.

Mr. F. J. Cole

Mr. F. Jasper Cole, M.I.Mech.E., M.I.E.E., technical engineer of the North Western Electricity Board's No. 5 Sub-Area (based on Blackburn) has been appointed manager of the Board's No. 7 Sub-Area (based on Stockport) to succeed **Mr. J. Harwood Lumsden**, M.I.Mech.E., A.M.I.E.E., upon his retirement in July next. Before nationalization, Mr. Lumsden was chief engineer of the Stalybridge, Hyde, Mossley and Dukinfield Joint Transport and Electricity Board and Mr. Cole was borough electrical engineer of Blackpool.

Sir Joseph Napier, Bt., O.B.E., has been appointed a director of Philips Electrical, Ltd.

Mr. J. T. Masterton has been appointed joint managing director of Brown Brothers, Ltd. Mr. Masterton joined the company in Edinburgh in 1921 and has filled managerial positions at its branches at Dundee, Leeds and Liverpool. In 1937 he was transferred to head office as joint general manager and was elected to the board in 1945. He was appointed assistant managing director in January, 1947, and will now act as joint managing director with **Mr. J. A. Thomson** who has been managing director since 1919 and chairman since 1930.

Mr. J. Wilson, M.I.E.E., A.M.I.E. (Aust.), managing director of the Wilson Electric Transformer Co., Pty., Ltd., of Port Melbourne, Australia, is now in this country. Correspondence should be addressed to him c/o The Bank of New South Wales, 47, Berkeley Square, London, W.1.

Mr. F. L. Parkin, B.Sc., M.I.E.E., A.M.I.Mech.E., has resigned his position as chief electrical engineer to Steel Peech & Tozer (branch of the United Steel Companies of Sheffield) to take up the appointment of general manager with Aerex, Ltd., fan engineers, of Sheffield, as from 2nd April.

C. S. Allott & Sons, consulting engineers, Manchester, have taken into the partnership **Mr. A. Bailey**, A.M.Inst.C.E., and **Mr. S. Gleaves**, M.I.Struct.E., both of whom have been concerned with the practice during a long period of years and have in more recent times acted as senior associates.

Mr. J. Shepherd has recently been appointed to the position of generation engineer (construction) with the North Western Division of the British Electricity Authority. Mr. Shepherd was formerly employed as senior mechanical engineer (C) with the North Western Division. Before nationalization he served with the Lancashire Electric Power Co. as resident engineer on Kearsley "C" and "D" extensions. Previously, he was employed as designer with a structural engineering firm. Also appointed as generation engineer (construction) with the North Western Division is **Mr. C. E. Pugh**, who was formerly employed as senior mechanical engineer (C) with the Division. Before nationalization he served with the Lancashire Electric Power Co. as assistant construction engineer.

Mr. J. Shepherd

Mr. C. E. Pugh

Mr. C. A. Smiles, A.M.I.E.E., after twenty years as manager of the South Wales territory of the English Electric Co., Ltd., relinquished his post for health reasons at the end of February. His services will still be available to the company in an advisory

capacity. Mr. Smiles was apprenticed with Cromptons, having previously served for several years in the Merchant Marine. As manager of the South Wales territory of the English Electric Co. he has been associated with a number of large installations, particularly in connection with steel works, which included rolling mills for Guest, Keen, Baldwins and for Guest, Keen and Nettlefolds, Cardiff, and also the twin-motor slabbing mill

Mr. C. A. Smiles

Mr. E. K. Wood

equipment in the continuous strip mill project at the Abbey Works of the Steel Company of Wales. During the 1914-18 war he served as acting lieutenant-commander in the Anti-Submarine Service.

Mr. E. K. Wood, A.M.I.E.E., who succeeds Mr. Smiles, has been fifteen years with the English Electric Co. He was in charge of the engineering of magnetic mine-sweeping equipments during the 1939-45 war, and was later appointed marine liaison engineer, Stafford. In 1945 he became resident liaison engineer with the Westinghouse Electric Corporation at Pittsburgh, U.S.A., and in 1947 went to the Cardiff office. For a short period in the last war he held a commission in the Royal Engineers, but was recalled to civilian service with the company.

Last Friday the Minister of Fuel and Power, **Mr. Philip Noel-Baker,** acting on behalf of the King, presented, at the Ministry, British Empire Medals to people employed in the fuel and power industries, including the following electricity supply men :—Messrs. A. F. T. Brider, Newport, Mon. (boiler house foreman, South Wales Division), G. H. Cowley, Runcorn, Ches. (conveyor attendant, Percival Lane power station), H. A. Hunstone, Tipton, Staffs (chargehand electrician, Ocker Hill generating station, Midland Division), F. N. Hunter, Birkenhead (boiler house fitter, Wallasey power station), J. B. Inglis, Plymouth (foreman linesman, South Western Division), W. C. Wilkinson, Newcastle-on-Tyne (electrician, North Eastern Electricity Board) and J. Williams, Rochester, Kent (Class 1 jointer, South Eastern Electricity Board).

Electricity supply men who received the British Empire Medal

As we reported at the time, **Mr. Peter Scott** was appointed manager of the Publicity Department of the English Electric Co., Ltd., last July. It is now announced that **Mr. Robert Johnson** (formerly senior export representative to Gillette Industries, Ltd.) has become assistant publicity manager and **Mr. Malcolm Logan** (until recently editor of the *Advertising and Marketing Review*) press relations officer. **Mr. J. H. M. Sykes,** who has been with the department for six years, has left the company to devote more time to his other business interests.

Mr. G. R. Millward, M.I.E.E., M.I.Mech.E., has been appointed chief electrical engineer (special works) to the Sudan Government Department of Public Works, Khartoum. He was formerly superintendent electrical engineer of the Sudan Railways, at Atbara.

Sir Percy H. Mills, K.B.E., managing director of W. & T. Avery, Ltd., has accepted the presidency of the Institute of Industrial Supervisors for a further year. **Mr. H. R. Harbott** (Smethwick Section) has been re-elected chairman of the Council for a second year and **Mr. W. J. Izzard,** chairman of the London Central Section, is chairman-elect of the Institute.

Mr. C. P. N. Rand, M.A. (Eng.) Cantab., A.M.I.Mech.E., M.I.E.E., who has been "on loan" to the Ministry of Supply for the

past eleven years, has returned to his former position of director of Electrical & Engineering Products, Ltd.

Mr. J. E. Peck, of the London district office of the Edison Swan Electric Co., Ltd., has been appointed manager of the Southampton district office with effect from 1st April, in succession to the late Mr. W. J. Maddick. Mr. Peck joined Ediswan twenty-eight years ago and served his first two years in the Technical Department for tungsten special filament design, followed by three years in charge of carbon filament manufacture, after which he was representative attached to the London district office. During the last war he served as technical electrical instructor to the R.A.F. and the Fleet Air Arm.

Mr. J. E. Peck

Mr. E. A. Armitage has been appointed by the St. Helens Cable & Rubber Co., Ltd., as an outside sales engineer in the Yorkshire area, attached to the Bradford office. Mr. Armitage received his technical education at the Leeds College of Technology and before joining the St. Helens Co. was with George Ellison, Ltd., as senior estimator at their Leeds branch.

In a recent window display competition organized by the Merseyside and North Wales Electricity Board, the Northwich Service Centre staff won the first prize in competition with over fifty Service Centres. **Mr. J. Eccles**, chairman of the Board, has given a challenge shield for this competition, and on 2nd April he presented it to the Northwich staff.

Mr. L. Smith receiving the Challenge Shield from Mr. J. Eccles on behalf of the Northwich Service Centre

Mr. J. O. Stanley, Mr. N. A. Twemlow and **Mr. B. J. Edwards** have been appointed to the board of Pye, Ltd.

Mr. Bernard Adkins, M.A.(Cantab.), M.I.E.E., A.M.I.Mech.E., Assoc.A.I.E.E., has been appointed to the University of London Readership in electrical engineering, Imperial College of Science & Technology, and will take up his duties on 1st October next. As a design engineer with the British Thomson-Houston Co., Ltd., Rugby, from 1928 to 1947, and from 1947 as a consulting engineer dealing with mathematical work in connection with special engineering problems, Mr. Adkins has been closely associated with the education of B.T.H. apprentices. Since 1947 he has been organizer and senior lecturer for the B.T.H. advanced engineering course and has assisted in the selection and training of graduate and student apprentices. From 1947-50 he was part-time teacher at the Rugby College of Technology and Arts for the post-graduate course in mathematics, and since January last has been special lecturer at the Imperial College of Science & Technology, London, for the post-graduate course on electrical machine theory. Mr. Adkins was educated at the Wyggeston School, Leicester, the Northampton School, and Clare College, Cambridge. He joined the B.T.H. as a student apprentice in 1925, having previously been a vacation student. He has been a frequent contributor to the technical Press.

Mr. B. Adkins

OBITUARY

Mr. S. Wolfe.—The death occurred on 3rd April, in his eightieth year, of Mr. Sidney Wolfe, until recently chairman and governing director of Wolf Electric Tools, Ltd., a business which he founded in 1900.

Mr. R. Cunningham.—The death has occurred of Mr. Robert Cunningham, who was Lancashire representative for Metway Electrical Industries, Ltd., from its inception until his retirement owing to ill-health three years ago.

WILL

Dr. H. R. Wright, chairman and managing director of Siemens Brothers & Co., Ltd., who died on 13th January last, left £201,339 gross (£191,091 net).

The Budget

Increased Burden on Industry

ON Tuesday last the Chancellor of the Exchequer (the Rt. Hon. Hugh Gaitskell) opened his 1951-52 Budget in the House of Commons. Among the changes in taxation which he announced was an increase in the tax on distributed profits from 30 to 50 per cent as from 1st January last; the tax of 10 per cent on undistributed profits is unaltered.

Referring to the impact of the defence programme upon the engineering group of industries, Mr. Gaitskell said that he had come to the conclusion that they must take steps to reduce the pressure of the home demand for plant and equipment for civilian purposes.

The initial allowance of 40 per cent for income tax and profits tax purposes on plant and machinery and 10 per cent on industrial buildings, mines and oilwells would be suspended as from 6th April, 1952. Any expenditure incurred after that date would continue to qualify for the ordinary annual depreciation allowances, but it would receive no initial allowances, which were introduced at the end of the war as a means of stimulating re-equipment and modernization.

Turning to purchase tax, the Chancellor announced that the rate on radio and television sets and gas and electrically operated domestic appliances would be raised from 33⅓ to 66⅔ per cent.

The existing rates of income tax would be increased by 6d in the £ but the allowances for married people and children would be raised by £10. Petrol would be increased in price by 4½d a gallon making it 3s 6d.

York Explosion

Ministry of Transport Report

A REPORT on the preliminary inquiry under the Boiler Explosions Acts into the mishap at the Foss Islands Power Station at York, North Eastern Division of the B.E.A., has been issued by the Marine Surveyors' office of the Ministry of Transport.

The steam boiler concerned was a John Thompson six drum "Alpha" water-tube type designed for an output of 59,000 lb/hr. at 200 lb/sq in and coal-fired by twin mechanical chain grate stokers. The explosion, which occurred on 27th October, 1949, killed one man and injured six others. The wrapper plate of the middle section water drum failed through the outer row of rivet holes for practically the whole length of the front longitudinal joint and was torn through the rivet holes of both circumferential end seams for a distance of about 3ft 6in, the boiler being thrown through the roof. The walls and roof of the boiler house and engine room were demolished, two overhead cranes collapsed and a destructor house was partly demolished. Numerous feed water and steam pipes were severed, causing steam to flash-off from two other boilers (reducing the water level to 2ft 6in below the bottom of the steam water drums) and damaging a third boiler by a 3ft 6in displacement.

The cause of the explosion was the combined action of stress and chemical action, otherwise known as caustic cracking, which spread from and between the outer row of rivet holes in the middle water drum wrapper plate until it failed under the working conditions.

The circumstances of this case, which have been fully investigated, and the comments of the Engineer-Surveyor in Chief are detailed in the lengthy illustrated report which is obtainable, price 5s, from H.M. Stationery Office.

At a meeting of the York City Council last week it was stated that the B.E.A. had denied liability for the loss of Corporation property as a result of the explosion. The Town Clerk was authorized to instruct Counsel to take proceedings in respect of a £14,500 claim.

Lighting Engineers

PROPOSALS for the training of apprentices which might eventually lead to a recognized examination for membership of the Association of Public Lighting Engineers were put forward by Mr. D. Lawson, new chairman of the Scottish Section of the Association at the Section's annual meeting at Hamilton on 4th April. Mr. Lawson said that lighting was very young as an engineering science and the number of persons directly interested in it was limited. The status of the lighting engineer could only be raised by setting a high standard of qualifications. To be able to insist on these qualifications, facilities for both practical and theoretical training must be available. Once a definite standard had been laid down, membership of the Association would be by examination only. The first essential would be an apprenticeship scheme of at least four years, a part of which would be spent in the drawing office and part on constructional work on site.

World Railways

THE publishers of the well-known book "Jane's Fighting Ships" have published the first edition of a similar type of illustrated technical work of reference entitled "World Railways 1950–51." Compiled and edited by Henry Sampson and published, at 63s, by Sampson Low, Marston & Co., Ltd., 25, Gilbert Street, London, W.1, this 600-page volume contains over 1,200 illustrations and presents an excellent survey of the operation and equipment of representative railway systems throughout the world.

Large-Scale Cooker Production

Benefits of Specialization

REFERENCE was made in our last issue to the very early days of electric cooking (1894) and the General Electric Co. was mentioned in this connection. Last week we had an opportunity of seeing how the G.E.C. cooker has progressed since Victorian times for in a museum at the company's Swinton (Yorks) works there is a historic collection arranged in date order. Some of the early models, although a little massive, still look capable of doing their job efficiently.

The works itself is one of the largest in the British Empire devoted solely to the production of electric cookers. In normal circumstances, i.e., when materials are freely available, it is capable of turning out 2,000 cookers a week. The site has an area of 24 acres and there is 400,000 sq ft of floor space on one level.

Scarcity of labour in Birmingham where the G.E.C.'s existing cooker factory is situated caused the company to look around for a place in which this problem did not exist and eventually it found and acquired a former munitions factory at Swinton. A great deal of reconstruction and "rehabilitation" was needed (including the removal of over 3,000 lorry loads of rubbish and the re-laying of two miles of railway track on the estate), a new building was erected for the pickling, plating, polishing and shot-blast departments and a rail and van loading dock was put up at the far end of the main building.

Although sufficient labour was available in the district it was necessary to give the men and women adequate training and this was done by a few instructors from the Birmingham works. Three months after the acquisition of the factory the first cooker was assembled and despatched in June, 1946. Then the company's first post-war model (the DC 113) was put into production; it was the first British domestic cooker to incorporate tubular sheathed oven elements. It was capable of providing for the needs of eight people although its overall dimensions conformed to B.S. 1195.

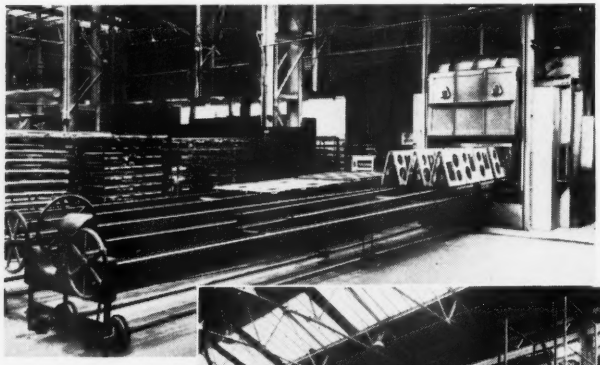
Now the factory is producing the new DC 114 type, the smaller DC 438E and the DC 138, a "bungalow" model. Concentration on these lines has enabled the works to be laid out in a logical way,

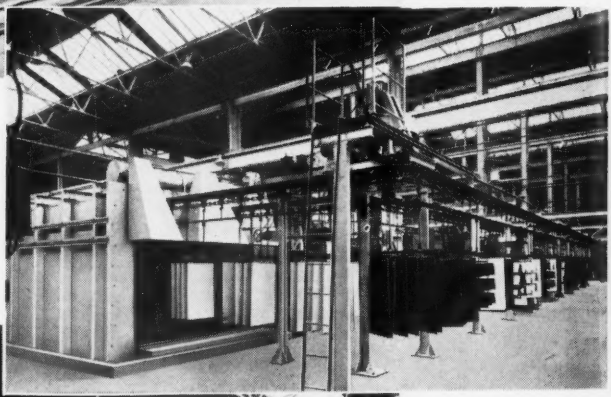
Operators making up embedded element hotplates

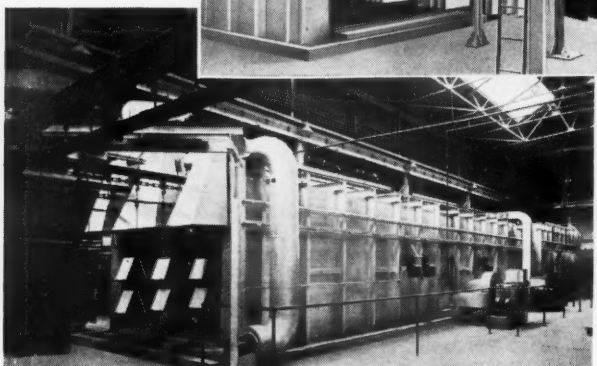
resulting in rapid and efficient production. The cooker bodies are of sheet steel on grey cast iron frames. From a store at one end of the fabrication department the sheets are taken to a battery of power presses. The pressings then go to spot and seam welders for fabrication, the largest being a 50 KVA 400 V machine for seam welding the oven bodies. Then the parts are degreased and pickled for enamelling.

From the castings stores cast components are taken for machining. They are then annealed and shot blasted before going to the vitreous enamelling department.

In this department enamel is produced from leadless powders in a series of ball mills ranging in capacity from 600 lb to one ton. From these the material issues in slip form and is taken to spraying booths and dipping tanks. Steel parts are given a grey-blue foundation coat which is fused on and the sheets after passing through steam-heated drying chambers go to the spraying booths for a further coat. Two tone ivory and green and cream are the combinations employed. For firing the enamel (at a temperature of about 840 deg C) there are five furnaces. Of these the most interesting is a 75ft long electric furnace through which the parts are carried by a continuous mechanical overhead conveyor 130 yd long. The four heating zones are arranged to give a gradual rise to maximum tempera-







Above: **Box type electric vitreous enamelling muffle.** *Right:* **Cooker side panels emerging from the vitreous enamelling furnace on the endless conveyor chain.** *Below:* **Side view of the 75ft furnace**

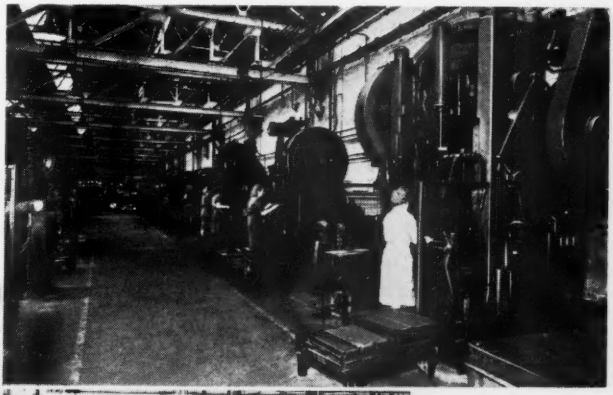
ture and a corresponding tapering off at the other end. Warning of a fall of temperature in any of the zones is given automatically. The speed of travel of the parts is about 2yd a minute and they spend about seven minutes in the hot zone.

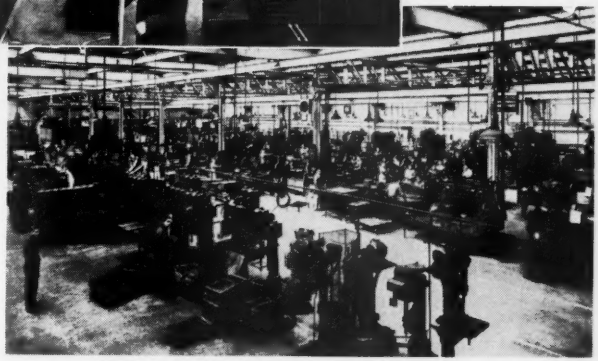
Another furnace is a long box type muffle which is loaded by means of a set of firing bars controlled by a single operator.

After inspection, the enamelled parts go to a bank of re-tapping machines to free threads and holes of enamel. Small auxiliary parts not liable to rough treatment are dipped, stoved and finished off in an infra-red drying tunnel. Parts which cannot be enamelled are nickel or chromium plated.

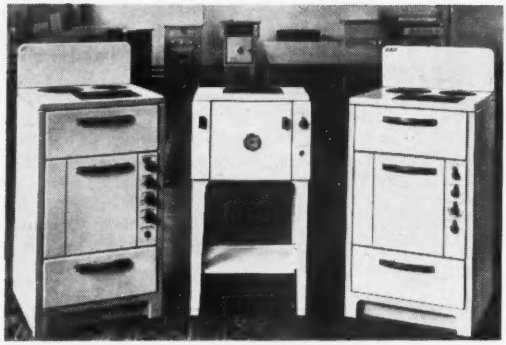
Elements for the ovens and radiant hotplates are produced in a separate department. Aluminium-bronze strip is bent to open circular shape for the inner sheath, the conductors are inserted and the refractory material packed round in a number of operations and the outer sheath is slipped on. The shaping of the completed tube is deftly performed by girls and the elements are tested and passed to the finished parts store.

For solid-type hotplates castings are first drilled and surfaced and then are filled in with refractory cement in a semi-dry state which is air dried and grooved for the resistor coils. These coils are wound on mandrels for various voltages and the end leads are welded on. They are then laid





Above: **Battery of power presses.** *Left:* **General view of fabrication shop.** *Below:* **Two of the cooker assembly lines**



Cookers in production:—*Left*, DC 114 with heated drawer; *centre*, the LC 138; and *right*, DC 114 with unheated drawer

in their grooves and a final filling of refractory covers them. After baking each plate is put on circuit for three minutes and then flash tested. Later there is a consumption test and a final flash test.

Grill boiler elements consist of two refractory formers into which the coils are threaded and connected to the three plug pins. The elements are then checked for consumption and inspected for correct assembly.

From the finished parts store the components are taken to the assembly shop. Here there are eight assembly lines down which turntable trolleys pass. Each point, or station, is numbered and the assemblers operate signals when their supplies of components need replenishing from the store. By the sides of the main assembly lines are sub-assembly benches from which the main lines are fed with certain cooker sections. Throughout the assembly inspection is continuous and inspectors' reports accompany the cookers to a service section in which a further inspection is made before the cookers pass to the central stores. This stores has a special section for the packing of cookers for overseas destinations.

The works has the usual ancillary services. In the administrative block, with well equipped offices, is the museum to which we have already referred.

South African News

From Our Cape Town Correspondent

THE bulk of a £3,000,000 contract for power equipment for the Orange Free State goldfields is being executed in Port Elizabeth. The contract is for seven large boilers and seven grate stokers—the biggest ever to be made in South Africa—which will be used by the Electricity Supply Commission at Vierfontein to provide electricity for the new gold mines. Delivery of the first two boilers is expected to start by the middle of this year.

A power station which will have the largest individual generating units in the Union (60,000 kW) is to be built by the Electricity Supply Commission at Taaiboschspruit, in the Orange Free State. The chairman of the Electricity Supply Commission said recently that the station would have four 580,000lb boilers and it would supply the Reef.

Although an increasing range of domestic electrical appliances is now made in South Africa, many dealers would prefer, if it were possible, to import such goods, as the high British standards are recognized in South Africa. It is considered that there will always be a market for the newest imported designs, especially those not made locally. The dealers say that import control has made South Africa partly self-sufficient in the manufacture of small electrical appliances. The manager of an electrical firm states that several overseas firms, when faced with reduced orders from the Union, opened factories in South Africa or licensed the production of their appliances by existing concerns. Electric lamps are being made near Port Elizabeth on a scale which nearly meets the Union's demands. Refrigerators are being assembled at Port Elizabeth and a firm is making electric stoves in Durban. Specialized household appliances are still imported. A small washing machine is made in South Africa, but the bigger models come from Great Britain and America.

New Germany, a quiet settlement near Durban, occupied by vegetable farmers, may become a thriving industrial centre as a result of the construction of an £8,000,000 power station by the Electricity Supply Commission. Railway lines and roads for the project are being constructed.

Scientific Instruments

Survey of the Physical Society Exhibition

From a Special Correspondent

ANY lingering doubts regarding the scope and efficiency of the British scientific instrument industry were dispelled by even a cursory glance at the equipment shown at the Imperial College, South Kensington, from 6th to 11th April. The interest shown in the exhibition was evident from the large attendance figures.

A description of the apparatus and of the demonstrations, most of them quite new, requires a handbook of more than 250 pages in which the exhibits of 110 manufacturers are covered, together with 34 separate research demonstrations sponsored by the universities and Government scientific establishments. The degree of progress made in the last 25 years can be gauged from the fact that the 16th exhibition, held in 1926, was supported by 70 manufacturers, while the catalogue ran to only 92 pages. Incidentally, the handbook of the present exhibition, as in past years, is an extremely useful guide for anyone who may be interested in the technical progress of the industry. It is very well indexed and produced and at a price of 5s it is a most economical reference book for any engineer, physicist or research worker who may be called upon to solve problems involving measurement or automatic control.

Survival of Craftsmanship

Modern pressure for increased production has a tendency to stifle the craftsmanship on which this industry is particularly based. It is therefore heartening to see the continued, and rather wider, interest in the apprentices' competition. These young instrument makers submit examples of their individual work and those shown this year are very creditable. It may be arguable that increased production necessitates careful planning and the manufacture of larger quantities of standardized articles. Nevertheless, it is essential that the individual craftsman should always be available, particularly for the research worker. If, therefore, competition of this kind encourages craftsmanship, it should be supported by all who have an interest in the industry. Similarly, thought should also be given to the individual firms who are not afraid to launch out in a new product, even though there may be little likelihood of large sales; at this exhibition there were numbers of instruments to be seen which were no doubt made for a special purpose and may never be repeated. That makers can indeed carry out such work, despite the tendency towards a machine-made type of product, is fully borne out by the number of firms who attend the exhibition year by year, where they enthusiastically demonstrate and describe their latest ideas.

Research Demonstrations

Apart from examining new products, a considerable time could be spent at the research stands. The Department of Scientific and Industrial Research and other Government research establishments had some most intriguing demonstrations, full of ideas and accomplishment, fully justifying the expenditure of public money. On Friday evening, two or three of these obtained the distinction of a " mention " in the B.B.C. news and provided for the layman some startling figures, as, for example, the ultra-high-speed repetitive Kerr cell camera with its 80 exposures at the rate of 400,000 per second, still maintaining a very high degree of resolution.

Another high speed instrument was an oscilloscope for the analysis of wave shape, which displays pulses of as short a duration as 0·1 micro-second on a 3in cathode ray tube. Another establishment had in operation an oscillator producing a sine wave whose frequency could be controlled from 0·16 c/s to 50 c/s—a very useful tool for the telecommunications laboratory. It is impossible to detail the full scope of these research demonstrations and they almost seemed to justify a separate exhibition of their own.

A great deal of work is now going on in connection with lighting problems. For instance, the Building Research Station

showed methods of studying glare and brightness with reference to the immediate surroundings. For this purpose, model rooms and fittings are used and one problem which has been overcome is that due to the inability of the normal flat, photoelectric barrier layer cell to conform to the cosine law, particularly at large angles of incident light. Such a condition arises particularly with modern distributed and diffused lighting and can cause considerable errors when using the normal type of photo-electric photometer, particularly if it is fitted with a glass cover plate.

An idea of Swedish origin has been tried out with success. This consists in fitting a translucent "Perspex" disc of critical dimensions over the cell. The edges of the disc collect a certain amount of light and thus provide an excellent compensation for the shortcoming mentioned above.

French Exhibit

Special mention should be made of the contribution made this year by French Government research departments. The usefulness of interchange of ideas and technique between the nations of Western Europe cannot be over-estimated. The French demonstrations were concerned with microscopy, atomic energy and some specialized apparatus, such as an equipment for the detection of cracks in wire threads of diameter between 0·8 and 32 mm.

Research is not by any means confined to Government organizations and some of the larger firms had demonstrations of their current activities. On more than one of these stands, it was evident that the use of germanium and other rare elements was being investigated. The Hall effect in germanium when related to the difference in frequency between two systems, can be arranged to produce a direct current proportional to the degree of out-of-step. Thus, a synchroscope can be provided on a normal d.c. meter. Germanium is being used for its photo-sensitivity and also in the commercial form of a crystal diode or triode.

Electronics are essential to many of the investigations of the modern research laboratory and the exhibition included a great number of amplifiers, oscillators, pulse generators, oscilloscopes and similar types of apparatus, together with various radio-frequency test sets. This type of equipment has probably developed and changed more during the past 25 years than any other type of scientific apparatus. In the catalogue of the exhibition held in 1926 "wireless receivers" were apparently the only type of electronic equipment to be seen.

A particular example of the link between old and new was an electrostatic wattmeter used for the measurement of iron loss, particularly on small samples. This quadrant electrostatic wattmeter was in general similar to the instruments of 40 years or more ago, but suitably modernized and in portable form. In the demonstration it was coupled with a duplex amplifier by means of which its range of usefulness was extended to frequencies of 10 kc/s. Other applications of this instrument to measurement of dielectric loss or power consumption of small fluorescent lamps will be obvious, and, by suitable design, it has ranges of 0/100 μW up to 6 kW.

Another example of an operating principle used for many years was a 250 kV electrostatic voltmeter of the attracted disc pattern, housed in a sealed off evacuated tube. The dimensions of the moving parts are very small and losses are reduced to negligible proportions. The movement, which is critically damped, is provided with a mirror so that a light beam can be used as the indicating device.

Atomic Energy Equipment

The use of atomic energy once more provided a fruitful field for ideas and developments. From the prospecting for radio-active ores to the use of beta and gamma rays as well as radio isotopes, in medicine as well as industry, a multitude of elaborate instruments and ancillary equipment was shown. For instance, self-contained power packs for extra-high d.c. voltages were to be seen on several stands and arrangements for the measuring of such voltages have been developed. The availability of a portable Geiger-Müller counter equipment adapted for use in the field suggests the intriguing idea of a profitable picnic as a prospector.

In previous years, various designs of thickness gauges, using beta and gamma rays, have been shown, and these have progressed greatly since their inception. But atomic energy is being used in other ways. One manufacturer suggested the checking of the filling of sealed packages on automatic filling machines. In this device, the

beta rays are so adjusted that they will pass through an empty package but not through one which is filled correctly.

The products of nuclear fission must be screened from the operator and some ingenuity has been used in preparing manipulators for remote control. Such arrangements may have their advantages, even for normal laboratories. There was on one stand a remote controlled balance with a capacity of 5 kg, designed for automatic charging and discharging and automatic loading of the weights. This balance, though at present intended for remote operation from a distance of a few feet could of course be developed further to provide complete remote control from greater distances.

Measuring Instruments

In the field of electrical measuring instruments, it was evident that though most designs still bear a family resemblance to those of 30 or 40 years ago, the detailed design of working parts and cases has progressed considerably during the past year. A similar remark applies also to such apparatus as galvanometers, potentiometers, bridges and resistance boxes. It is important that as better goods and equipment are required, there should be available measuring apparatus of increased accuracy and sensitivity in order to maintain the necessary close control. Not only is increased accuracy now available, but attention is being paid to the conditions of use. For instance, a shockproof galvanometer and d.c. amplifier were demonstrated alongside a similar set-up without the shockproof facilities. The difference in reading stability was very evident. In the particular example shown, the galvanometer was oil-immersed.

Increased inherent accuracy of apparatus requires that errors of observation shall be reduced and it was evident that considerable attention had been given to this in most apparatus. More could be done, however, to improve methods of presentation so that accuracy of reading, ease of reading and speed of reading, without undue fatigue to the operator, can be ensured. Some scales and pointers of indicating instruments, for instance, appear to be unduly fine for industrial use and although giving an impression of accuracy, are hardly likely to provide it, unless carefully used. One manufacturer did show a method of meeting this criticism. The scale plate of the instrument was dished so that the pointer moved in the same plane as the scale. Thus, the end of the pointer, which was thicker than the scale lines, swept the inner end of them. Reading was therefore easy and there was no parallax error. As in these instruments the plane of the scale had also been brought up to the level of the panel and a domed glass front fitted, troublesome shadows from directional lighting were eliminated.

Some new types of movement of electrical instruments were shown, one example being a moving-coil indicator with a 320 deg scale, achieved by driving the pointer from a normal movement by means of a ligament. Thus the linearity of the scale was preserved as well as the response time and damping of a normal high torque movement. Other exhibits of movements showed the availability of special types of scale, as, for instance, for "overload" ammeters with improved damping and general performance characteristics. One or two new multi-range test sets also appeared, specially arranged for industrial use, covering current, voltage, power and power-factor measurements. One of these contained the four essential instruments for simultaneous reading and was entirely self-contained in a portable case.

Remote Indication

On three stands there were methods of providing remote indication from either electrical or physical measuring instruments. Two of them had been shown before, but now incorporated considerable improvements. The third was demonstrated as measuring and transmitting a small displacement which actuated a cylindrical magnetic core inside the secondary windings of the convertor; with the core central, the output current is zero, increasing proportionally as the core is displaced, to a maximum distance of about 0·1in. Incidentally, the core is made from powder magnetic materials, providing one desirable feature, that the mechanical force required to move the core does not increase sharply due to displacement.

There were no substantially new recording instruments to be seen though different methods of application have been developed. One model of ink-on-paper recorder, however, was housed complete with its d.c. amplifier in a portable case. Its maximum sensitivity was ± 1 mV and it was designed

to follow frequencies up to 10 c/s. In this design the pen is driven by a two-phase induction motor and is servo-operated, the damping and overswing being adjustable. Another portable instrument for the recording, in the field, of time intervals or speed was shown in operation. This is fed from a local d.c. 12 V battery and includes its own computing network, using a precision vibrator as the time standard.

It is useful to reflect that machine tool design has, without doubt, been stimulated by the availability of better gauges and measuring devices, both for dimensional control and for finish and surface texture. This range now includes an instrument for the plotting of " roundness " both for interior and exterior of parts on a polar graph. The instrument shown was the first of its type.

High-Frequency Recorders

An interesting aspect of the problem of the measurement of high-frequency phenomena was solved by one exhibitor, who had arranged for a magnetic tape recorder to store the information. By subsequently playing back this record at a slower speed, analysing it and recording it on a high speed pen recorder using a Teledeltos paper, the effective frequency band of the recorder was increased from 100 c/s to 1,000 c/s. At a previous exhibition a somewhat similar experiment was shown in connection with the recording of faults on power lines, but in that case a cathode ray tube was the eventual indicator.

Another method using the cathode ray oscillograph is capable of recording, photographically from the tube, single or repetitive single high-speed transients, from 0·05 microsec to 2·5 millisec; the corresponding fastest writing speed is 20,000 km/sec.

Some of the apparatus shown, apart from its scientific usefulness, was quite fascinating to watch. There was a small equipment piercing the bore in a small diamond for wire-drawing purposes: holes as small as 0·002in diameter have been produced in such dies. Several coating plants, closely controlled by electronic methods, were operating and metallic and non-metallic films were being deposited. Though the technique has been applied for some time to optical components, there is a wide range of usefulness in other directions. One example is the depositing of a conducting metallic but transparent film on the cover glass of an instrument, in order to dissipate electrostatic charges which might be built up. In instruments having weak control, this charge can cause serious deflections and errors.

A logical computator demonstrated the automatic solution of logical problems, though to some spectators, the portion of the equipment which was labelled " Judgment Box " caused some misgivings. Nevertheless, the suggestion that the scheme could be extended and speeded up to deal with more elaborate problems offers attractions.

Servo mechanisms are now very widely used and the subject has developed its own technique and terminology. From the various examples which were shown, industry has cause to thank the mathematicians, physicists and engineers for the facilities which are now available for automatic control.

New electronic temperature controllers for industrial application, including electric furnaces, were shown in several forms. The advantages of such devices over existing methods include close setting, small and adjustable differential and almost negligible time lag, the last certainly being less than that of any thermo-couple or temperature detecting element with which they may be used.

Multi-Channel Grapher

On one of the research stands, which also featured a pyrometer for the continuous recording of liquid steel temperatures, there was an interesting model of a multi-channel grapher using electrical recording paper. This, in effect, has a single marker consisting of a helix on a drum which is rotated at a constant speed in synchronism with a balancing potentiometer. The unit automatically balances incoming signals against this potentiometer and at the point of balance, produces a pulse to mark the chart, which is in contact with the helix. By the use of a uniselector synchronized with the rotating helix, a number of incoming signals can be marked in succession at a high speed.

An optical method, using a photoelectric cell, was shown for the control or monitoring of strip metal. Primarily developed for hot or cold steel strip rolling mills, it does not depend on contact with the strip and is compensated for lateral movement of the strip up to $\pm$ 0·25 in. On normal commercial widths of rolled strip, it will record

variations in width over a range of ± 0·125in. For material testing, a supersonic flaw detector shown will deal with hair line cracks too small to be found by other methods. In this equipment a piezo-electric probe on the surface of the material transmits short pulses of energy which are reflected from the defect before those reflected from the far boundary of the material. The indicator is a cathode ray tube on which a steady reading is given of the state of the material. A wide range of testing frequencies is provided by the apparatus.

Many items and components were to be seen, designed for the more arduous circumstances met in tropical and industrial situations. These items included hermetically sealed rheostats, instruments and similar items, while for general use in control schemes, there were several automatic timing and sequence switching devices, time lag switches and sensitive relays. Valve retaining harness was a feature of one stand and suitable models are available for almost any type of valve used in equipment where vibration or shock may be expected.

Wind-Speed Measurement

In the meteorological section, various instruments which, no doubt, have been well tried out during the past few months, were being demonstrated. One which is being used in connection with the proposal to use wind turbines for power production is designed to measure wind gusts. It has a response time of less than 0·1 sec and is probably the best approach to the problem yet achieved. For some time, remote indication of wind speed has employed a typical electrical speed meter unit in which a voltage is generated proportional to speed. These units are somewhat unsatisfactory in that they do not respond quickly enough to changes in wind speed, owing to the inertia of the moving system. A new type shown comprises the usual anemometer driving a disc or shutter in which there is a series of holes. A beam of light chopped by this disc, falls on to a photo-cell producing a modulated signal capable of amplification. The inertia of the system is therefore very much reduced and by using a different series of apertures, the scale of the indicating instrument can be spread over various parts of the range, i.e., between 0·5 and 100 m.p.h.

In concluding a very limited review of this year's Physical Society Exhibition, congratulations should be expressed to the organizers, to the research organizations and to the manufacturers, for the skill and enthusiasm with which so many fundamental investigations and experiments are dealt, subsequently bringing into being apparatus for use in industry. Further arguments, if any are needed, to convince critics that the British instrument industry is alive, expanding and capable of meeting most demands, will be forthcoming in July, when at Olympia an exhibition devoted entirely to instruments, as well as to measuring and automatic control techniques, will be held. It is also satisfactory to learn that the science and art of measurement has not been forgotten in the various exhibitions organized in connection with the Festival of Britain.

DIELECTRICS SUMMER SCHOOL

A SUMMER school on the theory of dielectrics will be held at the University of Liverpool, in co-operation with the Institute of Physics and the British Electrical and Allied Industries Research Association, from 19th to 21st July. Lectures will be given by Prof. H. Fröhlich, Dr. B. Szigeti and other members of the Department. The course is intended mainly for research workers in Government and industrial research laboratories who wish to familiarize themselves with the theoretical aspects of subjects with which they are concerned on the experimental side. The summer school will be followed by a conference on dielectrics from 23rd to 25th July. The speakers will include Dr. L. Hartshorn, Prof. H. Fröhlich, Prof. J. G. Kirkwood, Prof. J. C. Slater, Dr. M. Magat, Prof. C. P. Smyth and Dr. S. Whitehead. Particulars of both summer school and conference may be obtained from Dr. B. Szigeti, Department of Physics, The University, Liverpool, 7, or from the deputy secretary of the Institute of Physics, 47, Belgrave Square, London, S.W.1.

Rating of Boards' Premises

Commenting at a National Chamber of Trade meeting at York last week on a Halifax resolution calling for a full investigation into the "preferential rating treatment which appears to be allowed to the nationalized gas and electricity boards' retail premises," Mr. E. P. Rickard (Rotherham) said that the municipal electricity department at Rotherham had paid £61,000 a year in rates, but the Yorkshire Electricity Board paid only £3,000. The resolution was approved.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

Pendant Lighting Fitting

A NEW pendant lighting fitting is available from the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, with a range of attractive lighting bowls in various colours, with line or lace design decoration. The metal work is die-cast, with a pale brass, brushed copper or satin silver finish. The bowls are of two diameters, 18in for use with three 60 W lamps, and 22in for three 100 W lamps. In the 18in size the bowls are in champagne or pink, with gold or silver line decoration. Similar 22in bowls are available, while in this size there is also a peach bowl with lace design decoration, and a rimpled amber bowl decorated with gold lines.

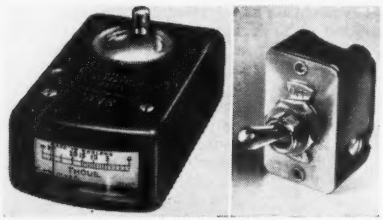
Easily Ejected Plug Top

A patented three-pin 15 A plug top specifically designed for easy removal from the socket is now available from CLANG, LTD., Crown Yard, Cricklewood, London, N.W.2. The feature of this accessory is that by pressing the thumb on the centre button, a stub acts on the socket between the pins and ejects it. The plug was first demonstrated about a year ago by the inventor in a television programme and now that the patent rights have been acquired by the company it is to be known as the "Clang Ejector Plug."

Thickness Meter

A pocket-sized instrument for the measurement of non-ferrous layers on ferrous bases produced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is essentially a moving iron magnet reluctometer and requires no electrical supply. It is available in three single-range forms of 0–5, 0–10, and 0–30 thousandths of an inch.

Left: **G.E.C. layer thickness meter.** *Right:* **Arcolectric 10 A toggle switch**



Toggle Switch

The latest single-pole toggle switch to be introduced by ARCOLECTRIC (SWITCHES), LTD., Central Avenue, West Molesey, Surrey, is rated at 10 A, 250 V a.c. or d.c. It is priced at 3s 10d.

Clothes Airer and Dryer

In a new clothes dryer and airer made by J. & H. WALTER, LTD., 19, Charing Cross Road, London, W.C.2, drying is carried out by actual intimate contact with a central heated plate, the clothes being held against this on adjustable hanging rails (or they may be simply hung over the top). It is claimed to be impossible to scorch the garments.

When drying, the garments are covered by plastic curtains which swing open on hinges. The curtain rails can be slipped out and the feet folded if it is required to pack the dryer away flat. The unit, which measures 3ft high by 22in wide by 6in deep, has a loading of 250 W. The retail price is £4 14s 6d (plus 21s P.T. in this country).

Walter clothes dryer and airer

E.A.W. Conference

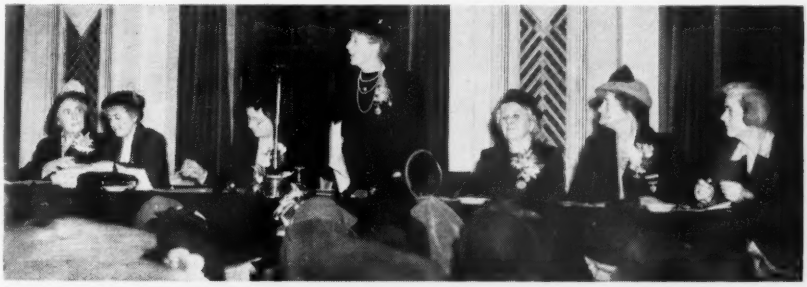
Educational Aspects of the Association's Work

THE growing importance of the Electrical Association for Women as a voluntary social service was emphasized last week by the Minister of Fuel and Power, Mr. Philip Noel-Baker, at a luncheon in London attended by over 500 on the occasion of the twenty-sixth annual conference of the Association. It was the object of the Association, he said, to tell housewives how best to use electricity. This meant educating them as to how to avoid using electricity at peak hours and how not to waste electricity, and so coal, at all hours of the day and night.

He hazarded a guess that power cuts during the winter months could not have cost less than £8–10 million in industrial production, some of it dollar export goods. He also guessed that industrial users and housewives had saved between 40,000 and 50,000 tons of coal a week since Christmas. The Association had played a big part in this patriotic effort. The demand for power had risen by 30 per cent in three years and was going on expanding. In the United States the consumption of electricity had multiplied three times in twenty years and he estimated that it would have increased another three times by 1970.

Mrs. M. E. C. Stewart, chairman of the Perth Branch of the E.A.W., said that in the twenty-six years of the Association's existence there lay a magnificent record of work in the educational field, in the scope of electrical appliances and in the more intelligent use of electricity in industry and the home. The day would come when the traditional style of house building must give way to newer plans and new designs. New schemes and designs in the heating, lighting and cleaning of their homes would be required and it was for them to see that theory did not too far outstrip practicability and on the other hand that every encouragement should be given to the bold and experimental.

Mr. William L. Batt, Minister in Charge, Economic Co-operation Administration in the United Kingdom, declared that it was absurd to expect women to take an ever greater part in social, cultural, political and economic life unless they were freed from the ancient drudgeries of the kitchen. Science and industry had made it possible for women to assume these responsibilities instead of remaining slaves to the kitchen stove. He urged women "not to let themselves be pushed around." If they said they wanted more goods at lower prices they would get them. But the people in all countries could have more only if they produced more. Here and there it might be difficult for the moment because of some raw material shortage, but this could be overcome by ingenuity and resourcefulness. Standardization and simplification



Lady Swaythling addressing the annual general meeting. With her on the platform are *(left to right)* **Mrs. A. T. Dover, Miss V. Norvick, Dame Caroline Haslett, Mrs. A. B. Lewis, Mrs. G. A. Tatchell and Miss A. S. Lockhart**

Speakers at the luncheon: Mr. W. L. Batt, Dr. Edith Summerskill and Mr. Philip Noel-Baker

provided one means of producing larger volumes of a commodity at a lower cost.

Dr. Edith Summerskill, Minister of National Insurance, said that legislation concerning the housewife always lagged behind other reforms. It had to be recognized that the energy of the housewife was being wasted: in no factory would such waste be allowed.

The Dowager Lady Swaythling, president of the E.A.W., was in the chair at the luncheon at which the guests included Mr. E. Shinwell, Minister of Defence; Lord Hurcomb, chairman, British Transport Commission; and Mr. Alfred Robens, Parliamentary Secretary, Ministry of Fuel and Power.

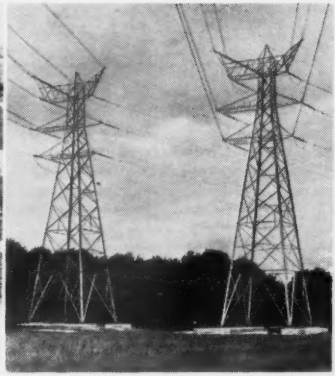
At the annual general meeting which preceded the luncheon the annual report was presented by the director, Dame Caroline Haslett. Restrictions on apparatus and current, she said, had meant a regretted deferment of hopes for women who had come to realize the significance of electricity in bringing the home into the forefront of development. The curtailment of electrical amenities had shown what time-taking improvisation was needed without them, and it had also demonstrated how closely the modern home was integrated with commerce and industry.

Past officers' badges were presented by Lady Swaythling to Mrs. A. B. Lewis, J.P. (chairman) and Mrs. G. A. Tatchell, J.P. (treasurer). The Lady Hughman Challenge Bowl was also presented to the winner of the annual golf competition, Mrs. A. T. Dover.

Councillor Miss N. Balls, J.P., Mrs. D. E. Coulson, Miss N. Kenyon, Miss H. Shaw and Mrs. H. F. Truman were elected to fill vacancies on the National Executive Committee. Area representatives co-opted were: Mrs. J. Heyworth (Rawtenstall), North Western and Merseyside and North Wales Areas; Mrs. W. S. Carty (Sunderland), North Eastern Area; Mrs. Crosher (Sutton Coldfield), Midlands and East Midlands Areas; Mrs. Wild (Halifax), Yorkshire Area; Mrs. G. M. Bradley (Aylesbury), Eastern Area; Mrs. C. U. Cole (Woolwich), South Eastern Area; Mrs. Trevor Rees (Swansea), South Western and South Wales Areas; Mrs. Wimshurst (Isle of Wight), Southern Area; Lady MacColl (Glasgow), Scotland. Lady Swaythling was re-elected president, with Mrs. A. T. Dover as chairman and Mrs. A. B. Lewis as treasurer.

Production Conference

IT was with the object of making information available to industry about the contribution which more efficient factory electrification can make to the country's efforts to increase production that a conference on the subject was organized by the Utilization Section of the I.E.E. in November, 1950. The series of lectures then delivered, in not too technical language, dealt with motor power, industrial heating processes, welding, handling and inspection of materials, lighting, heating and ventilation. An illustrated 52-page report of the proceedings, with discussions, is now obtainable for 6s post free from the Institution of Electrical Engineers, Savoy Place, London, W.C.2.



132kV Lines at Poole Harbour

Tower Erection on Difficult Ground

THE new 200 MW generating station of the B.E.A. Southern Division at Poole Harbour in Dorset, which was brought into commission at the end of 1950, is supplying energy into the grid by way of 132 kV overhead lines erected by W. T. Henley's Telegraph Works Co., Ltd.

The station site is reclaimed marshland on which enormous quantities of material had to be tipped to build it up above tidal flood level. The station building foundations required piling and large mass concrete constructions. Several of the overhead line tower foundations sited on the marshland also needed particularly heavy foundations and it was these features, coupled with the nature of the approach to the power station, which gave the overhead line contract some rather unusual aspects.

The contract provided for the erection of two 0·175 sq in s.c.a. double-circuit steel tower lines approximately 6 and 2½ miles long, both emanating from the station switching compound. The shorter line loops into the existing Bournemouth–Dorchester line and the other runs direct to Bournemouth. Both new lines carry 0·07 sq in s.c.a. earthing conductors and run parallel to each other for the first mile-and-a-half from the power station, when the routes diverge.

The bearing strength of the soil at six out of the first seven tower positions from the power station on each line was so low that reinforced concrete piles had to be driven for the tower foundations. The tension loadings on the towers had to be compensated by mass concrete foundations and the high-tide level over the marshland area was another factor which necessitated this construction.

The illustrations will convey an idea of some of the difficulties encountered in constructing the tower foundations. It will be noticed that the mass concrete foundations are continued well above ground level, because it was impracticable to excavate to a greater depth than 5ft in the waterlogged marshland.

The lines cross over Poole Harbour and, to provide access to and foundations for one of the tower sites, a road 600ft long had to be constructed by the Southern Division of the B.E.A. by tipping chalk and ashes to build up the level. The road ended with a similarly built-up island large enough to carry two tower foundations.

The heading block shows (*left*) preparation of tower foundations at Poole and (*right*) two of the towers showing projection of foundations above ground level

Inquest on Linesman's Mate

A RECOMMENDATION that the Yorkshire Electricity Board should amend its safety rules was made by the jury at an inquest recently on Maurice Wilson (24), a linesman's mate, who received a fatal shock while repairing a low voltage line at Todmorden. Mr. C. Haigh, general assistant engineer employed by the Board, said that when he closed a switch on a high voltage line he had completely forgotten that he had told the linesman's mate to repair a fault on the l.v. line which would be affected by the switch. He was preoccupied with the h.v. line. It was stated that Mr. Haigh had been working until 2.45 a.m. that day on storm damage. A verdict of "Death by misadventure" was recorded.

PARLIAMENTARY NEWS

From Our Special Reporter

IN the House of Commons last week the Postmaster-General (Mr. Ness Edwards) made a statement announcing increases in charges for certain Post Office services including the raising of the present charge of 2d for local telephone calls from a kiosk to 3d. This will come into operation as soon as the necessary adaptations can be made to coin boxes, probably about 1st October. The minimum charge for an ordinary inland telegram will be increased from 1s for nine words and 1d for each additional word to 1s 6d for 12 words and 1½d for each additional word. For greetings telegrams the present minimum charge of 2s for 12 words will remain unchanged, but additional words will be charged at 1½d.

Sulphur Supplies

Mr. W. Shepherd asked the President of the Board of Trade whether any action was being taken to obtain the sulphur supplies available in Iceland.

Mr. H. Wilson said that the possibility of obtaining sulphur from Iceland was being investigated, though he understood that no immediate supplies were practicable.

Mr. Osborne asked if the supplementary quota of 19,000 tons of sulphur which was being given by the United States Department of Commerce to meet our current production needs would be sufficient to avoid the previously anticipated 40 per cent cut in rayon production.

Mr. Wilson said that this amount was to cover the period until export allocations for the second quarter of the year were notified. Until their allocation was known, he could not say whether or not the effect on rayon production would be of the magnitude previously anticipated.

Replying further, Mr. Wilson said they were doing everything possible, and allowing free importation of sulphur and sulphur products from wherever they might be found. It was a very long job indeed to increase the production of sulphuric acid, particularly in this country.

Mr. Harrison asked if there were any prospects of supplies of synthetic or manufactured sulphur.

Mr. Wilson said he was not aware of synthetic or manufactured sulphur, but they were pushing ahead very fast with the use of anhydrites, pyrites, spent oxide and other substances.

Use of Fuel

Mr. Carr asked the Minister of Fuel and Power how far, in his consultations with industry about the more efficient use of fuel, the application of financial incentives and methods of compulsion were considered as a means of procuring certain minimum standards of efficiency.

Mr. Noel-Baker said that the Fuel Efficiency Committee and other bodies had from time to time suggested various financial incentives. Their use, however, raised considerable administrative difficulties. The Fuel Efficiency Committee had stated that the co-operation of consumers was preferable to compulsion. A major difficulty was that many particular sources of inefficiency were not susceptible to enforcement by general regulation. Study of this aspect was being pursued.

AUTOMATIC MONITORING EQUIPMENT

THE B.B.C. is responsible for producing nine or ten different sound programmes which are directed over lines to nearly 100 transmitters, where they are radiated for reception in all parts of the world. Apparatus by means of which the Corporation hopes to release for other services personnel who have been employed in keeping a listening check on the technical quality of these programmes is described in a paper which was read at a meeting of the Radio Section of the Institution of Electrical Engineers in London last week by Mr. H. B. Rantzen (late B.B.C. now U.N. Telecommunications Services) and Mr. F. A. Peachey and Mr. C. Gunn-Russell (both of the B.B.C.).

The authors explain that the apparatus performs its task not by judging from an absolute basis, as has so often been done by the staff employed for this purpose, but by comparing the content of the programme at a point where it has already been checked with that at a more distant point. If the programme at two such points differs by a predetermined amount, the monitor sounds an alarm calling the attention of an engineer, normally engaged on other work, to remedy the trouble.

As communication plant becomes more reliable, the occasion of such alarms becomes more infrequent and the duty of continuously watching a programme will be reduced to that of occasionally dealing with a fault. In conclusion the authors explain that although the capital cost of the equipment is such that a profit from the saving of staff salaries should be apparent in the first two years, the greatest saving of all is in the staff released from this soul-destroying type of duty for more interesting work with better prospects, elsewhere in the B.B.C.

Commerce and Industry

Copper and Zinc Exports

Radio and Electronic Components

IN March an announcement was made on behalf of the Board of Trade and the Ministry of Supply stating the principal grounds on which applications for the granting of exemption licences under the Prohibited Uses of Copper and Zinc Orders would be considered. One of the conditions for licences for export was that the goods should show a conversion factor of at least fifteen times in the case of exports to the dollar area and Sterling Commonwealth countries and at least fifty times in the case of exports to other markets. For this purpose, the following definitions have been made:—

Dollar Area.—Canada (including Newfoundland); U.S.A. (including Alaska, Hawaii, Puerto Rico, Virgin Islands, Guam, Samoa); America Account countries:—Bolivia, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Venezuela, the Philippines; Persia. *Sterling Commonwealth countries.*—The whole of the British Commonwealth, excluding Canada, but including all the Colonies, and the Anglo-Egyptian Sudan. (Other countries of the Sterling Area are not included, namely, Iceland, Iraq, the Irish Republic, Burma and Jordan.)

Since the Orders prohibit *manufacture*, the manufacturer of the goods, whether or not he is himself the actual exporter, should make the application for an exemption licence to the appropriate Regional Controller of the Board of Trade or Ministry of Supply in his area.

World Metallurgical Congress

It has been decided by the Economic Co-operation Administration that it will sponsor, provided sufficient support is forthcoming, a mission to the World Metallurgical Congress of experts from O.E.E.C. countries to be held in Detroit, United States. The mission will visit factories and research institutions in the United States. Dr. Zay Jeffries is the Director of the Congress, which is sponsored by the American Society for Metals. Engineers and others from the United Kingdom wishing to be nominated as members of the O.E.E.C. mission may obtain information from the British Engineers' Association, 32, Victoria Street, London, S.W.1.

Anglo-German Patents

An agreement has been concluded between the British Government and the Government of the Federal Republic of Germany whereby the time for making belated applications for United Kingdom patents with priority based on a corresponding application deposited in a filing office at Damstadt or Berlin, may be extended until a date not later than 31st May next, provided the application so deposited continued to be dealt with by the Patent Office of the Federal Republic. Extensions have been granted by the Government of the Federal Republic for making applications in that country founded upon applications in the United Kingdom. The agreement is given effect by the Patents (Extension of Time) (Federal Republic of Germany) Rules, 1951.

Infra-Red Paint Stoving

The paint stoving plant built by Morris Commercial Cars, Ltd., for use in their own works incorporates "Metrovick" infra-red element projectors. These are standard units for mounting into a framework to suit the product being stoved. In this particular plant large car sections are stoved in 14 to 16 minutes. This may appear to be a longer time than usual with such plants but it suits the customers' production enabling them to put through mixed parts, both large and small, and it eliminates the necessity of batching. Ten 4 kW

"Metrovick" infra-red plant for stoving car sections at Morris Commercial Cars, Ltd.

"Metrovick" projectors are fitted but by means of the temperature control panel this 40 kW load can be reduced to suit production requirements.

Stage Lighting Colour Media

Before the war BX Plastics, Ltd., supplied about 50 per cent of the cellulose acetate for colour lighting effects for theatres and cinemas. Production was suspended during the war, but has now been resumed, and although output at the moment is limited by the shortage of raw materials, Mr. R. Maitland, sales director, who presided at an informal luncheon in London last week, stated that he anticipated that these shortages would be overcome, and that the company would be able to build up sufficient stocks of "Cinabex" non-inflammable colour medium within a year to meet all demands. With the resumption of the production of this cellulose acetate, the quality has been considerably improved and the range of colours now totals thirty-six, which it is thought is sufficient for all purposes. Each colour is available in sheet form in sizes 54in by 24in and 27in by 24in. The company has appointed eight distributors through whom "Cinabex" can be obtained.

Engineers' Guild

On 3rd April the Engineers' Guild, Ltd., was registered as a company limited by guarantee without share capital. The number of members is unlimited, each being liable for £1 in the event of winding up. The objects are to acquire the assets and liabilities of the existing unincorporated association known as the Engineers' Guild and to "promote and maintain the unity, public usefulness, honour and interests of the engineering profession, etc." No person is to be admitted to membership, other than honorary membership, unless he is a corporate member of the Institutions of Civil, Mechanical or Electrical Engineers. The management is vested in a Council, the first members of which are:—H. Nimmo, Southern Electricity House, Maidenhead; W. S. Graff-Baker, Acton Works, Bollo Lane, W.3; T. M. Megaw, 136, Ruden Way, Epsom Downs, Surrey; C. G. L. Morley, 149, Exeter Road, Harrow; and others.

Thomas De La Rue Exhibition

A private exhibition of the products of Thomas De La Rue and Co., Ltd., will be held at the galleries of the Royal Society of Painters in Water Colours, Conduit Street, W.1, from 2nd to 19th July. Exhibits of historical interest from the company's own museum will help to tell the story of development from early Victorian times, and among the articles shown will be several which were on display at the Great Exhibition of 1851, when the business had already been in existence for nearly forty years. From the factories of the Industrial Group there will be examples of the company's work in laminated and extruded plastics. Admission will be by invitation. The Security Division will be open to visitors from 2nd to 4th July and the Industrial Division from 5th to 19th July.

Gas Analysis Equipment

In a paper which was read on Monday last (9th April) at a London Students' Section meeting of the Institution of Electrical Engineers Mr. D. W. Foster and Mr. W. E. M. Arundel dealt with the more frequently encountered types of electrically operated instrument for gas analysis, particularly those relating to combustion processes. Special attention was given to carbon-dioxide measurement, together with carbon-monoxide-hydrogen mixtures, which are equally important. Reference was also made to refrigeration practice and to the measurement of hydrogen purity in connection with the recent advent of the hydrogen cooled alternator.

Radio Components Exhibition

The eighth annual private exhibition of the Radio and Electronic Component Manufacturers' Federation held from Tuesday until Thursday of this week at Grosvenor House, London, demonstrated once more the high standard of workmanship and skill which British engineers are putting into the design and manufacture of components for the radio and allied electrical industries.

The exhibition was opened by the president, Sir Robert Renwick. There were 112 exhibitors, ten more than last year, and 170 categories of exhibits comprising all types of magnetic materials, plastics, components, valves, instruments and test gear for the radio, television, electronic and telecommunication industries, which ranged from sub-miniature valves and components for hearing aids to heavy duty types for industrial electronic equipment and high power transmitters. The effect of television and Service requirements on the industry is particularly marked.

Many advances in design have clearly been made and improved manufacturing techniques put into operation, for this country is now the world's leading exporter of radio components, the value of exports having increased twelvefold in five years. They are now running at the rate of £6 million a year and in 1950 were valued at £5·3 million.

Advice to Salesmen

The appliance salesman's duty is not only to sell equipment; he is also expected by the customer to be able to give sound advice. To help in this direction Mr. W. F. Lorch (manager,

Domestic Appliances Department, Falk, Stadelmann & Co., Ltd.) recently gave a lecture at his company's showroom, Mount Street, London, W.1, to a gathering of retail salesmen. He dealt with a number of the smaller domestic electrical appliances—irons, kettles, toasters, blankets, etc.—and in addition to describing their construction and operation mentioned the most common faults, many of them being due to the customer's improper use. He gave advice on methods of dealing with these faults (and with the customer) and stressed the need for acquainting manufacturers with all the details when an appliance was returned for attention.

German Industries Fair

The Heavy Industries Section of the German Industries Fair is being held at Hanover from 29th April to 8th May. The electrical industry will be represented by 650 exhibitors and will occupy 28,800 sq metres or 20 per cent of the covered space available. Inquiries in connection with the Fair should be addressed to Schenkers, Ltd., 27, Chancery Lane, London, W.C.2.

Power Transmission Directory

From the Trade and Technical Press, Ltd., 65–66, Chancery Lane, London, W.C.2, we have received a copy of the eighth edition of the "Power Transmission Directory and Trade Names Index" (price 5s). This publication relates to mechanical power transmission equipment and in addition to giving names and addresses, in classified sections, of makers of this equipment also contains some useful information. An innovation is a section on industrial electric motors and other electrical apparatus, comprising alphabetical and geographical lists of suppliers.

Management Practice

The Institute of Industrial Administration, in conjunction with the British Institute of Management, has arranged a residential course of study at Wadham College, Oxford, from 21st–28th July next on the subject of "Management Practice." The course is designed to meet the needs of managers (especially of small and medium firms), potential managers and executives who are unable to attend formal courses of instruction at technical or commercial colleges. The inclusive fee is £12 12s and particulars can be obtained from the education secretary of the Institute of Industrial Administration, Management House, 8, Hill Street, London, W.1.

Battery Additives

All motorists and lead-acid storage battery users will find much of interest and value in a 30-page booklet entitled "Battery Additives," compiled by Paul L. Howard and George W. Vinal and published by the American National Bureau of Standards as Circular 504; it is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, 25, D.C., price 15 cents.

During the past 25 years several leaflets have been issued by the National Bureau of Standards on the subject of battery additives, many of which have been exploited as panaceas for lead-acid storage battery failures. These leaflets were an expedient means of answering numerous inquiries about such materials. They were revised as occasion required and the present booklet comprises a more extended statement. It shows by means of a comprehensive series of comparative tests that these materials are not effective.

Nickel Plating

The need to make the most economical use of nickel now that the metal is scarce has caused the British Standards Institution to issue a memorandum on (instead of revising) B.S. 1224, which is the only standard specification for electrodeposited nickel and chromium on steel and brass. Attention is thereby drawn to two relaxations which (definition of significant surface, page 5 of B.S. 1224) enable the manufacturer, by agreement with the purchaser, to reduce the surface to be coated in accordance with the standard requirement and (classification footnote, page 7 of B.S. 1224) permit the minimum coating thickness to be a composite deposit of nickel and copper, provided that the final deposit of nickel is at least 50 per cent of the whole.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £120 0s 0d
COPPER, H.C. Electro	ton £202 0s 0d
Fire Refined 99·7 per cent ..	ton £201 0s 0d
Fire Refined 99·2 per cent ..	ton £200 10s 0d
LEAD, English	ton £137 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £1,300 0s 0d
ZINC, G.O.B. Foreign	ton £151 0s 0d
Electrolytic	ton £155 0s 0d
BRASS Tubes	lb 1s 9½d
Sheet	lb 2s 0–d
Wire	lb 2s 3d
COPPER Tubes	lb 1s 11 d
Sheet	ton £247 0s 0d
H.C. wire and strip	ton £226 10s 0d
PHOSPHOR BRONZE	
Wire	lb 3s 5½d
RUBBER, No. 1 R.S.S. spot ..	lb 59½d–60d

Hydro-Electric Plant for Australia

The State Electricity Commission of Victoria, Australia, has just placed an order with Boving & Co., Ltd., London, for Eildon power station, worth £A1,250,000 and covering two vertical Francis water-turbines rated at 82,000 h.p.,

to drive alternators being supplied by the British Thomson-Houston Co., Ltd., Rugby. Each alternator will be rated at 66,667 kVA, 11,000 V, 3-phase, 50 c/s, 150 r.p.m. The turbines are believed to be of the greatest output and the alternators to be physically the largest ever ordered in Britain. The overall diameter of the alternators will be about 40ft, and each will weigh approximately 500 tons. The order also includes a 250 ton gantry crane. Eildon power station is associated with a large combined irrigation and hydro-electric scheme on the Goulburn River.

Machinery Trades Convention

It is announced by the Association of Electrical Machinery Trades that a convention will be held at the Imperial Hotel, Llandudno, on 1st and 2nd May. Papers are to be read by Mr. R. K. Allan (Skefco) on "The Practical Application of Roller Bearings to Electrical Machines" and by Mr. A. G. Sweetland (B. I. Callender's) entitled "Winding Wires—A General Survey."

The Association has produced an illustrated 12-page pamphlet "Training in Electrical Engineering Power Plant Craftsmanship" which aims at attracting the right type of youth to the industry.

Trade Announcements

Smart & Brown (Machine Tools), Ltd., announce that they are in no way connected with Smart & Brown (Engineers), Ltd., who have recently been acquired by Thorn Electrical Industries, Ltd.

Carter Industrials, Ltd., have removed to Windsor House, 46, Victoria Street, London, S.W.1 (telephone: Abbey 3741).

The London office of **Premier Electric Heaters, Ltd.,** under the managership of Mr. S. E. Whorton, is now at Crown House, Aldwych, W.C.2 (telephone: Temple Bar 7639).

Mr. E. R. Rogers, the Northern representative for electrical products of the **Westinghouse Brake & Signal Co., Ltd.,** has removed to 26, Park Road, Timperley, Altrincham, Cheshire (telephone: Sale 3583).

A new factory has been acquired at East Middlesbrough Industrial Estate, Southbank Road, Cargo Fleet, Middlesbrough, by **K.X. Lamps, Ltd.,** where the company is to concentrate the manufacture of all types of automobile bulbs and other miniature lamps.

Engineer Buyers and Representatives

The second annual meeting of the Engineer Buyers' and Representatives' Association was held at the Waldorf Hotel, London, W.C.2, on 30th March. Mr. L. E. Van Moppes (director of L. M. Van Moppes (Diamond Tools), Ltd.) deputised for the president, Sir Herbert G. Williams, M.P. The report of the Council showed that receipts from subscriptions and fees had increased by over 30 per cent and there had been a consistent and accelerating inflow of applications for membership.

The president and hon. vice-presidents were re-elected. Sir Thomas G. Spencer (managing director, Standard Telephones & Cables, Ltd.) and Mr. J. Sherwin (works director, Commer Cars, Ltd.), were elected as hon. vice-presidents.

Sulphuric Acid Price Increase

The Board of Trade announces that the increase in the maximum price of weak sulphuric acid is 27s 6d per ton, not 25s 6d as was stated last week.

Catalogues and Lists

E. Shipton & Co., Ltd., Ferndown, Northwood Hills, Middlesex.—Illustrated catalogue of telephone equipment.

Siemens Electric Lamps & Supplies, Ltd., 38-39 Upper Thames Street, London, E.C.4.—Catalogue of illuminating equipment offering suggestions for lighting displays in connection with the Festival of Britain.

W. T. Glover & Co., Ltd., Trafford Park, Manchester, 17.—Two catalogues, one of trailing cables for mining purposes and the other of "Glo-Clad" wiring system accessories and lead-alloy sheathed cables.

Evershed & Vignoles, Ltd., Acton Lane Works, London, W.4.—Illustrated catalogue (No. 242) of electrical measuring, recording and controlling instruments.

TRADE MARKS

APPLICATION has been made for the registration of the following trade marks. Objections may be entered up to 28th April:—

FIBRAK. No. 695,861. Class 1. Material (not being insulating material) consisting of paper pulp for use in making up into separators for electric batteries.—Oldham & Son, Ltd., 36, Hyde Road, Denton, near Manchester.

SHERWEN. No. 678,760. Class 7. Electro-magnetic vibrators (machines) and electro-magnetically operated vibrating machines for mineral concentrating, screening, sieving, feeding, conveying, concrete consolidating, barrel packing and for bunkers and foundry box shakeouts.—General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

TELECEL. No. 692,076. Class 9. Electric accumulators.—Alkaline Batteries, Ltd., Union Street, Redditch.

VOLEX. No. 692,411. Class 9. Electric switches, insulated electric wire and cables.—Ward & Goldstone, Ltd., Sampson Works, Frederick Road, Pendleton, Manchester.

REDILARM. No. 693,947. Class 9. Instruments, apparatus, systems and parts included in Class 9 for the production, transmission, reproduction, control, measurement or indication of signals of sound wave frequency, of carrier wave signals modulated at sound wave frequency or of television or other image signals.—Central Rediffusion Services, Ltd., Carlton House, Lower Regent Street, London, S.W.1.

PICOPAC. No. 695,951. Class 10. Hearing aids.—Thomas Thirsk, 41, Lodge Road, West Croydon.

VESPALITE. No. 695,922. Class 11. Emergency lighting apparatus (complete).—John Westaway, 18, Harrow Road, Brooklands, Sale, Cheshire.

"Brabazon" Electrical Equipment

Need for a Constant-Speed Drive

THERE was a very full attendance at an ordinary meeting of the Institution of Electrical Engineers in London last week when Mr. M. J. J. Cronin (Bristol Aeroplane Co., Ltd.), read a paper on the development of the electrical system in the Bristol "Brabazon I Mark I" aircraft, one of the most ambitious installations so far fitted in any aircraft in this country.

The paper deals mainly with the development of the power supply system, but attention is also given to the problems involved in designing aircraft electrical equipment in general. The author briefly outlines the development of typical equipment and shows how its specific weight has progressively decreased

Electrically the "Brabazon" presented many problems and the distances separating the pilots and engineers from the engines and other controls necessitated the extensive use of electrical transmission, thereby opening up a new field of interest for the electrical engineer. The normal electrical services, however, mainly follow industrial practice, but not without modification and complication. The wiring for example is in p.v.c. insulated cable with an outer covering of glass braid and all connections have been made with crimped solderless terminals.

The aircraft has a 200 V a.c./28 V d.c. power supply system using six three-phase 30 kVA alternators driven from the engines, and six three-phase 6 kW metal rectifiers. Owing to the problem of engine speed variation this system uses frequency relays to alter the turns ratio on the rectifier transformers at predetermined speeds so as to provide 1,200 A of d.c. power at 28 $\pm$0·5 V and about 30–144 kVA of a.c. power over a 4 : 1 speed range. The performance characteristics of this system are stated and its operating characteristics are finally discussed in the light of the results obtained by extensive instrumentation of a ground test rig.

The author explains that the aircraft is a prototype and is virtually a flying test bed, and because the scope of the subject is so large it is not possible in the paper to cover the design of the individual items of equipment or describe any of the specialized electrical controls which are now in common use in aircraft.

DISCUSSION

The discussion was opened by Dr. E. A. Watson (Joseph Lucas, Ltd.), who said that the first impression given by the paper was one of complexity, which perhaps arose because the mechanical engineer had not made a good job of his side of the work; if he had provided a constant-speed drive everything would have been very simple. The advent of the small gas turbine as an auxiliary power unit might make a difference, because its power/load ratio was much better than that of any other prime mover and it would be an ideal drive for an alternator and the constant-speed a.c. system which everyone desired.

Mr. C. G. A. Woodford illustrated a method of load transfer switching which, he claimed, showed that it was possible to develop a very simple stand-by system giving full reliability of supply to the essential services without a cumbersome system involving busbars, rectifiers, power transformers and discriminative protecting equipment.

Mr. R. H. Woodall (Rotax) suggested that constant-speed drive was desirable not only for a.c. machines but equally for d.c. machines in order to save weight.

Mr. V. A. Higgs (B.T.H.) said the time had come when the electrical industry should insist upon having from the aircraft industry constant-speed drive, either from the main engines or from a separate engine. He was sorry that the "Brabazon" and the Saunders-Roe "Prince" had been developed without the parallel development of a gas turbine auxiliary generating plant. He was convinced that the electrical industry, given suitable encouragement, could develop a first-class gas turbine auxiliary generating plant economic in weight.

Mr. J. F. Lewis (Ministry of Supply) thought there was still uncertainty about the choice between a.c. and d.c., at least for larger aircraft. While constant-speed drives were still not available to give acceptable reliability and life, he wished that a turbine-driven auxiliary generating plant had been developed.

Mr. E. R. Lloyd (Air Registration Board) urged that as much attention should be paid to auxiliary supplies as had been given to the main supplies. A great deal of complexity could be avoided, weight saved and greater reliability achieved by having a central supply for these services at a fixed frequency.

Mr. J. Clyde (Ministry of Supply) said that a good deal of development work had been carried out in this country on constant-speed drives, primarily on the mechanical side, but up to the present there was not a gearing light enough for aircraft. The Americans had developed a hydro-mechanical gear, but it was rather heavy. Before a constant-speed gear could be applied to aircraft its weight should be of the order of 1–1·5 lb/h.p. and it should give at least 1,000 hours of trouble-free operation.

Mr. I. O. Hockmeyer mentioned that one aeroplane, the "Shetland," had been fitted with an auxiliary generating plant. It was conceived as long ago as 1940, and was very successful until somebody ran the auxiliary plant without opening the cooling ducts, thus setting fire to the aircraft.

Mr. J. G. M. Pardoe, an aeronautical engineer, said that if "electrics" were to be used for essential services such as power-operated controls it would be necessary to have three auxiliary generating plants, because at some time two of them would stop. To increase the complication in this way would be a serious matter for the operating crew.

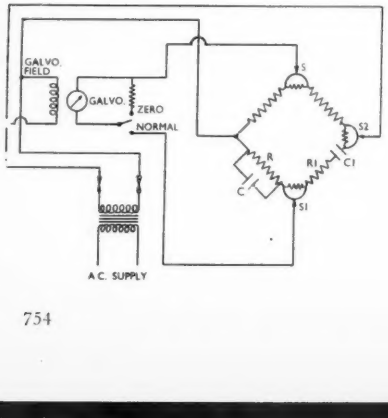
Dr. G. A. V. Sowter and Mr. S. A. Stevens also took part in the discussion, to which the author replied.

Frequency Recorder

THE recording of frequency is of importance in a number of industries, and there has for some time been a need for a recorder of extremely high accuracy covering the small range of frequency usual for power supplies. Where, for example, an industrial process is dependent on the reception of current at a steady frequency, within certain limits, a continuous record of variations in the supply frequency is essential for accurate process control.

George Kent, Ltd., have developed an instrument for this purpose which is based on a prototype originally designed for use in the company's research department. The circuit is essentially that of a Wien bridge in which the resistors and capacitors, R, R_1, C, C_1, have the values necessary to provide the required frequency range, usually 47 to 51 c/s. S, S_1 are mechanically coupled slide-wire contacts working in tandem which balance the circuit until no current is passing through the galvanometer. The scale of the instrument is very nearly linear and the accuracy is 0·03 c/s over the whole range; the recorder is sensitive to changes in frequency of less than 0·01 c/s. Although the range is normally 47 to 51 c/s, the circuit values can be adjusted to cover other small ranges of frequency of the same order and standard scales are available reading 47 to 51, 51 to 47 or 48 to 52 c/s.

Basic circuit of the new Kent frequency recorder



Colour Television

TELEVISION in colour is being installed by one of the largest department stores in the United States for the merchandising of wearing apparel for men, women and children besides many other types of articles. This announcement was made recently by Remington Rand, Inc., manufacturers of the "Vericolor" system of closed-circuit colour television and the Jordan Marsh Co., of Boston, which will be the first store of its kind to employ the new system. By means of "Vericolor" the latest fashions on sale can be seen simultaneously by people either inside the store or from outside through the display windows.

New Third Programme Transmitter

The two 100 kW Marconi air-cooled transmitters installed at Daventry for the B.B.C. Third Programme

ON Sunday last a new high-power transmitter and mast radiator was put into service at Daventry for the Third Programme on the existing wavelength of 464 metres. The installation has two of the latest Marconi 100 kW air-cooled transmitters, with paralleling equipment, to give an output of 200 kW but, to conform with the Copenhagen Plan, the actual power used will be limited to 150 kW.

This equipment is housed in the oldest surviving B.B.C. transmitting station and now occupies the space where, 25 years ago, the B.B.C. installed its first high-power transmitter for long-wave broadcasting. The installation consists of two 100 kW transmitters arranged in line with a special paralleling unit between them, in which the outputs are combined.

An advance in technique has been achieved in these transmitters in that all valves are air-cooled. This eliminates the large reservoir and water-cooling system previously needed for transmitters of this power. Air-cooling also simplifies design, installation and maintenance. A feature of the design allows the 15,000 cu ft of air per minute used for cooling to be extracted and used to heat the transmitter hall.

The new transmitter is not only more than twice as powerful as its predecessor, but has also been provided with a more efficient aerial on a 725ft B.I.C.C. mast, specifically designed to give as large a fading-free service area as possible. It is expected that the average radius of the service area will be about 100 miles. Toward the north and east it will be rather more than this and the number of listeners able to receive the Third Programme will be increased to about 70 per cent of the population.

Coaxial Television Cable

WHEN delegates to the recent International Consultative Committee on Telecommunications (C.C.I.F.) conference in London visited Sutton Coldfield at the invitation of the B.B.C. they saw the world's largest television transmitting station being fed by programme signals sent from London by coaxial cable. Later they saw a demonstration of the quality of television signals transmitted over coaxial cables.

The cable follows the route of the old Roman road via Watford, Aylesbury, Daventry, Coventry and Birmingham. The main cable, forming part of the Post Office trunk telephone network, covers a distance of just over 121 miles, with 43 repeater stations en route, of which 11 are required for present-day programmes. The cable terminates at Museum Exchange, London, and Telephone House, Birmingham, and the end connections to the transmitters are provided by tail cables. The London–Birmingham cable incorporates two 0·975in and four 0·375in coaxial tubes. The larger tubes are used, with repeaters at 12-mile spacing, for two-way transmission of 405-line television signals requiring a video bandwidth of approximately 3 Mc/s. Ultimately these tubes may be required for very-high-definition or colour television and frequencies up to 26 Mc/s may be involved with repeaters at three-mile spacing. The 0·375in tubes are used for broad-band telephony purposes, each pair being capable of carrying 600 speech circuits. On the Birmingham–Stoke cable, 0·375in tubes are used for the 405-line television transmissions, the repeater stations being at six-mile spacing. The cable was provided and operated by the G.P.O., and was developed, manufactured and laid by Standard Telephones and Cables, Ltd.

Electronic Process Controller

UP to the present time the majority of process controllers have been pneumatically operated so considerable interest is therefore attached to a paper describing an electronically operated controller which was presented by Mr. J. R. Boundy and Mr. S. A. Bergen (both of Evershed & Vignoles, Ltd.) at a meeting of the Measurements Section of the Institution of Electrical Engineers in London last week.

The authors first of all briefly state the fundamental principles of process control and explain that controllers commonly have three modes of control known respectively as proportional, integral and derivative actions. A description of their operations then leads to the mathematical equation which any process controller must solve. In the case of the controller described solution is by electro-mechanical methods.

The basic principles of one method of converting the physical quantities to be measured into d.c. are then described and it is shown that this particular method permits the use of a purely electronic controller. The circuit arrangements of the controller which solves the fundamental equation are then given in detail. The d.c. output from this controller is used to position the orthodox pneumatically operated process-control valve by means of an electro-pneumatic relay mounted on the valve.

This electronic form of process control is shown to offer several inherent advantages. Transmission distance is almost unlimited, response time lag is eliminated and as the controller settings are made by adjustment of potentiometers of known resistance, associated with coils of known resistance, the calibration of scales is more accurate, easily calculable and above all repeatable. Apart from ease of servicing, the problem of matching the controller to the plant characteristics is greatly simplified and the system allows the maximum use to be made of the mimic-diagram form of supervisory control. Although the controller and associated equipment are slightly more expensive than the older established pneumatic equivalent the reduction in installation costs, size of control rooms, etc., make the total cost of a complete installation less than for the pneumatic type.

The authors then describe the method of operating the controller when it is installed on a plant and in conclusion they give details of a most interesting electronic process analogue used for testing the controller. It is hoped that when further experience has been gained with this latter equipment it will be possible to reproduce any process in the laboratory by setting into the analogue values obtained by observation and estimation of the plant for which the controller is intended. In this way, disturbance of the plant may be minimized by the determination of optimum settings before the controller is installed.

Underground Coal Gasification

INVESTIGATIONS into the gasification of coal underground in the United States is the subject of a paper presented at the Institute of Fuel in London by Messrs. J. L. Elder (Synthetic Liquid Fuels Branch, Bureau of Mines, U.S. Department of Interior) and E. T. Wilkins, M.Sc., Ph.D. (Fuel Research Station, D.S.I.R., London) who outline the continuation on a large scale of the experiments commenced in 1947 at Gorgas, Alabama, by the Bureau of Mines and the Alabama Power Co.

Between March, 1949, and July, 1950, some 10,000 tons of coal was burned underground by the "steam" process, which involves lighting a fire in a passage (pre-formed in the coal seam) through which air is pumped to maintain combustion.

The calorific value of the gas so produced was 100 B.Th.U./cu ft when the off-take borehole was close to the burning coal face, but lower in other circumstances owing to the gas generated being partly burned underground by air by-passing the reaction zone. Attempts to stop this loss of air were not successful and a great deal of heat was lost through the overburden, both by leakage of hot gas and by conduction from the burnt-out area.

Two aircraft-type superchargers have been used as turbo-blowers (open cycle gas turbines) to augment atmospheric air sent down the borehole to sustain combustion underground. The gas (under pressure and circulated underground to raise its temperature to not more than 1,400 deg F) contained about 18 per cent carbon dioxide and virtually no oxygen during the 100-hour trials. Its calculated calorific value ranged from 12 to 28 B.Th.U./cu ft and (at a discharge temperature not above 1,100 deg F) it burned steadily at the exhausts of the turbines.

The experiment was prejudiced by loss of gas (80 per cent) through leakage underground. Nevertheless the remaining 20 per cent provided power (turbines in parallel with blowers in series) for pumping 20 per cent of the air needed for combustion, which is claimed to mean that even the present inefficient installation could have been self-supporting if leakage of gas underground could have been avoided.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Associated Electrical Industries, Ltd.—The annual meeting was held on 3rd April, Mr. Oliver Lyttelton (chairman), presiding. In the course of his speech Mr. Lyttelton said that 1950 was once again a year of increased production, but the figures were affected towards the end of the year by the decision of the hourly rated employees at the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd., to work only on day-work. Piece-work, however, was resumed in February.

Deliveries of finished apparatus amounted to more than £55 million during the year, while orders on the books greatly exceeded £100 million in value. They were well spread over the next three of four years. During the year they carried out their long-held intention to divest themselves of the physical assets and undertaking of the Metropolitan-Vickers Co., that that company should be separately capitalized, and that A.E.I. should then become its sole shareholder. To-day, therefore, A.E.I. was almost entirely a holding company.

Referring to the rearmament programme, the chairman said that the maintenance of the free flow of raw materials for their manufacturing plants would be difficult. In any rearmament programme the electrical industry must be one of the highest priority, and they had hopes that these shortages would only affect a small part of their business. They must, however, expect difficulties in maintaining the production of certain types of their lighter electrical appliances. Any falling off was likely to be more than offset by armament orders in the heavier sections. They had planned, as the armament programme advanced, that those of their factories engaged on such products as domestic appliances should be organized for the manufacture of components for the heavier side.

The group supplied a large proportion of the power station equipment for the British Electricity Authority, and during 1950 turbo-generator sets for the B.E.A. of a total capacity of over 690,000 kW were put into service. Among orders received was one for another B.T.H. 60,000 kW turbo-alternator set for Staythorpe. Ferguson, Pailin had a large order for air-blast circuit breakers for Carmarthen Bay. Metropolitan-Vickers were supplying a large part of the motors and switchgear for the Fawley oil refinery, and the cables for the refinery were manufactured by Edison Swan. The whole of the 19,000 h.p. of main drives and nearly all the auxiliary drives and control gear for the Rogerstone (Mon) plant of the Northern Aluminium Co. for rolling aluminium and aluminium alloy sheet and strip on the continuous system, were supplied by the B.T.H. Co., which also supplied six large d.c. motors totalling 28,000 h.p. for the Steel Co. of Wales. Metropolitan-Vickers supplied the motors totalling 1,850 h.p. for the roughing end of the same mill and all the 3,300 V switchgear.

With regard to exports, orders for the year attained a total of £26 million, or 38 per cent of the total orders booked in 1950. A particular feature of their exports had been the large increase in traction orders, Metropolitan-Vickers having booked orders for 48 diesel-electric main line locomotives for the Western Australian Government, 40 main line locomotives for the New South Wales Government, and ten locomotives for the Parana Railway, Brazil. B.T.H. traction orders included ten diesel-electric switching locomotives for the N.S.W. Government, 18 for the Western Australian Government, and a large order for thirty-two 1,500 kW mercury arc rectifiers for the Victorian Railways. There were also orders for waterwheel alternators for export.

In the field of X-ray and electro-medical equipment, Metropolitan-Vickers had developed a 10 million electron volt X-ray equipment for the Medical Research Council, and were building three 4 million electron volt equipments for clinical use. Preliminary tests on the 300 million electron volt synchrotron constructed for the Department of Natural Philosophy at Glasgow University had been completed.

Important orders had been received for equipment for ships and aircraft, while on the domestic appliance side, the Hotpoint Electric Appliance Co. had made good progress and in the past year exceeded its previous year's production by nearly 50 per cent. Edison Swan had greatly increased their output of valves for radio and television sets. Last year the output of the Sunderland factory alone was equal to the previous record of the Sunderland and Brimsdown factories combined.

The Jerusalem Electric & Public Service Corporation, Ltd., held its annual meeting on 5th April when Mr. W. Shearer (chairman), who presided, said that sales during the year under review in the Israel area amounted to 16,249,631 kWh, an increase of 5,188,000 kWh over the previous year,

while the number of consumers increased from 19,300 to 20,832. Distribution efficiency improved from 75.3 per cent in 1949 to 83.7 per cent, and the load factor increased from 20.2 per cent to 32.4 per cent. To meet the rising cost of operation discussions commenced in August, 1949, with the appropriate authorities for an increase in tariffs, but the position at the end of the financial year under review was that the authorities had stated that unless fresh capital was procured no increase would be permitted. Following further representations in October, 1950, an increase in charges was permitted. The fresh capital was required to complete the Corporation's contribution to the bulk-supply agreement with the Palestine Electric Corporation, and to provide further plant and material in Jerusalem itself. An application to the Capital Issues Committee to raise £500,000 was not granted, and efforts to obtain a dollar credit in New York were unsuccessful. In view of the Corporation's inability to implement the bulk-supply agreement, both parties decided to terminate the agreement. Other means of providing foreign currency were being examined.

The British Engine Boiler & Electrical Insurance Co., Ltd., reports premium income, etc., for 1950 of £1,717,985, as compared with £1,584,456 for 1949. Claims and other outgoings totalled £1,460,391 (against £1,374,547). After providing for unexpired risks, the profit is £204,182 (against £148,684). The final dividend on the £5 shares is 21s, making 38s for the year (against 34s), and the balance carried forward is £427,665 (against £376,425 brought in).

Parmiter, Hope & Sugden, Ltd., propose to pay an interim ordinary dividend of 7½ per cent. This is the first interim dividend to be paid and does not imply any intention in regard to the total for the year. A first and final dividend of 25 per cent was paid for 1949-50.

The Superheater Co., Ltd., reports a profit for 1950 of £178,509, as compared with £163,301 for the preceding year. After making allocations to various reserves, it is proposed to pay a final dividend on the ordinary and "A" ordinary shares of 17½ per cent on capital increased by a 50 per cent bonus (against 19 per cent on capital increased by a 33⅓ per cent bonus), making 32½ per cent for the year (against 39 per cent). The balance carried forward is £57,938 (against £42,926 brought in).

The National Gas & Oil Engine Co., Ltd., reports a net profit for 1950 of £293,437, as compared with £217,752 for 1949. Depreciation requires £45,140 and taxation £50,000. Reserve for future taxation receives £130,000, special depreciation £85,000, and general reserve £50,000. The ordinary dividend for the year is 6 per cent (against 5 per cent), and £44,985 is carried forward (against £43,172 brought in).

The Rheostatic Co., Ltd., reports that, after making provision for depreciation, managing director's remuneration, income tax and profits tax, the profit for the year ended 30th September last amounted to £31,308, which compares with £25,610 for the preceding year. It is proposed to pay a final dividend of 12½ per cent making a total of 16½ per cent (against 16 per cent) for the year. General reserve receives £14,535 (£11,500) and £6,360 (£8,085) is carried forward.

Telegraph Condenser Co., Ltd.—Total profits in 1950 at £331,922 were almost exactly double those of 1949 (£165,239). Taxation rose from £67,812 to £147,793 and the contribution to general reserve was increased from £50,000 to £120,000. A final dividend of 15 per cent (10 per cent) is to be paid making a total of 20 per cent (15 per cent) for the year, and £49,363 (£48,265) is carried forward. It is proposed to raise the capital from £280,000 to £580,000 by the creation of 600,000 new ordinary 10s shares and to capitalize £50,000 of general reserve in distributing 100,000 new ordinary shares as a scrip bonus on a one-for-three basis.

J. & F. Stone Lighting & Radio, Ltd., has declared an interim dividend of 10 per cent, actual, less tax (same).

New Companies

Drake & Gorham (Contractors), Ltd.—Registered 3rd April. Capital £150,000. To acquire the business of electrical, mechanical and hydraulic engineering contractors carried on by Drake & Gorham, Ltd. Solicitors: Wigan & Co., 19, Surrey Street, W.C.2.

Speedy & Eynon (1951), Ltd.—Registered 29th March. Capital £20,000. Electrical and mechanical engineers and contractors, etc. Marguerite B. Scriven is the first director. Solicitors: Harold Roberts & Lea, Birmingham, 3.

Solenoids & Regulators, Ltd.—Registered 29th March. Capital £5,000. Manufacturers of and dealers in electrical switchgear and control gear, solenoids and mechanical apparatus used in connection therewith, etc. Subscribers: H. I. Yarwood and A. T. Yarwood. Solicitors: Wallace Robinson & Morgan, Birmingham.

R. G. Heaton & Son, Ltd.—Registered 30th March. Capital £1,000. Electrical contractors, manufacturers, importers and exporters of and dealers in radio and television sets, electronic and domestic appliances, etc. Directors: S. W. Rothwell and F. Yeates. Regd. office: 108, Alexandra Road, Moss Side, Manchester, 16.

W. R. Davies (Electrical Engineers), Ltd.—Registered 28th March. Capital £1,000. Directors: W. R. Davies, Mrs. Dora Lowry and Mrs. Doreen Nobels. Regd. office: Bank Chambers, High Street, Kettering.

Radar, Radio & Television, Ltd.—Registered 20th March. Capital £2,000. To acquire the business of radar, radio and television carried on by L. Freedman at 26, Oakleigh Road South and 384, Bowes Road, New Southgate, N.11; and to carry on the business of electrical, radio and television engineers, etc. Directors: L. I. Freedman and Mrs. Winifred Freedman. Regd. office: 26, Oakleigh Road South, New Southgate, N.11.

W. V. Fairhurst, Ltd.—Registered 20th March. Capital £7,000. Electrical and mechanical engineers, manufacturers of and dealers in electrical apparatus and goods, etc. Directors: A. Leach, E. S. Jepson, H. H. Fairhurst and W. H. Fairhurst. Regd. office: 209, Duckworth Street, Darwen.

John S. Knight, Ltd.—Registered 22nd March. Capital £6,000. Electrical, mechanical and general engineers, iron and brass founders, etc. Directors: J. S. Knight and E. Wibberley. Regd. office: 55, Mersey Street, Warrington.

Increases of Capital

Desoutter Brothers (Holdings), Ltd.—Increased by £699,900, in 350,000 5½ per cent cumulative preference shares of £1 each, and 1,399,600 ordinary shares of 5s each, beyond the registered capital of £100. Converted into a public company on 28th February.

Denis Ferranti Co., Ltd.—Increased by £99,000, in £1 ordinary shares, beyond the registered capital of £3,000.

B. French, Ltd.—Increased by £15,000, in £1 ordinary shares, beyond the registered capital of £5,000.

Winding-up Petition

Auto-cold Refrigeration, Ltd.—A petition for the winding-up of the company, presented by Marco Refrigerators, Ltd., is to be heard at the Royal Courts of Justice, Strand, London, on 23rd April.

Liquidations

Blaenau Electrical Supplies, Ltd., Electricity House, Rhostyllen, Wrexham. Liquidator, Mr. A. P. Whyte, Electricity House, Love Lane, Pall Mall, Liverpool, 3, appointed 16th March.

R. G. Heaton & Co., Ltd., electrical contractors and engineers, 108, Alexandra Road, Moss Side, Manchester, 16. Winding up voluntarily. Liquidator, Mr. J. Ross, 16, John Dalton Street, Manchester, 2.

Green Electrical & Engineering Co., Ltd.—Winding up voluntarily. Liquidator, Mr. H. Campbell-Bakes (Eric E. Potter & Co.), Midland Bank Chambers, James Street, Harrogate.

R. Sawrey, Ltd., electrical engineers, 29, Stephenson Place, Chesterfield. Liquidator, Mr. P. Cardwell, 93 Queen Street, Sheffield, appointed 19th March.

Brook Motors, Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. H. L. Simpson, Bank Chambers, Market Street, Huddersfield. Particulars of claims to the liquidator by 30th April. This notice is purely formal. All creditors have been or will be paid in full.

Delhi Electric Supply & Traction Co., Ltd. (in voluntary liquidation).—Particulars of claims by 30th April to the joint liquidators, Messrs. A. W. R. Lovering and S. H. Taylor, Suffolk House, Laurence Pountney Hill, London, E.C.4.

Meetings of Creditors

Lauray Electrical Co., Ltd.—A meeting of creditors is to be held at the offices of Shindler & Co., 23-25, Eastcheap, London, E.C.3, on 26th April.

Edgworth Electrics, Ltd.—A meeting of creditors is to be held at 98, London Road, St. Albans on 19th April.

Underwood Electric, Ltd.—Meeting of creditors on 17th April at Winchester House, Old Broad Street, London, E.C.2.

Bankruptcies

H. Harris, television dealer, and **H. J. Midwinter**, television engineer, both of 1, Overbury Street, Charlton Kings, Glos, trading as Harris & Midwinter.—Receiving order made 30th March on a creditor's petition.

H. H. Baron, 84, Duckworth Street, Darwen, Lancs, electrician.—Supplemental dividend of 10s in the £, payable 13th April at the Official Receiver's office, 20, Byrom Street, Manchester, 3.

W. B. Johnson, manufacturer and retailer of neon lights, 18, Elm Park Road, Wallasey, and lately carrying on business at 114a, Brighton Street, Wallasey, under the name "Fluorescent Neon Display Co."—Receiving order made 14th March on debtor's own petition. First meeting held 6th April, at the Official Receiver's office, 25, Water Street, Liverpool. Public examination 22nd May at the Court House, Pilgrim Street, Birkenhead.

A. F. Howsley, electrical engineer, 25, Emesgate Lane, Silverdale, Lancs.—Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester, 2, released 14th February.

STOCKS and SHARES

NOW that the Budget is out of the way, its uncertainties resolved and the worst known, Stock Exchange markets can settle down into more normal conditions than those to which they have been accustomed of late. The shadow of the Budget had affected the consol market, and all gilt-edged securities, in a manner which proved heavy and depressing, causing sales of British Government securities and diverting the money, at any rate to some extent, into the ordinary shares of industrial companies. Shares of the latter class possessing ample cover for their dividend distributions, have been in demand. During the week Aron gained 2s 6d at £2, and London Electric Wire a florin at 50s 9d. Cable & Wireless ordinary put on 5 points to 117½. In the "heavy" group, Babcock & Wilcox stood out with a rise of 3s to 72s 6d.

Associated Electrical Industries

During the current year Associated Electrical Industries will have paid in taxation more than five times the distributed profit. In real terms, the 20 per cent dividend declared on the nominal ordinary capital, represents a return of only about 4¼ per cent on the £28 million actually invested in the business by ordinary stockholders. Mr. Oliver Lyttelton gave other figures at the meeting which put into perspective the proportion of profits distributed in dividends. Over the past three years, the amounts paid on that account total £3 million before, or £1·65 million after, income tax. In the same period, the company has paid more than £10 million in taxation, and £57 million in wages and salaries, which increased on the average by 17 per cent. In five years, nearly £19 million has been invested in the business, through issues or retention of profits. The new rate of dividend remains, of course, in the highly conservative class, being covered five times by the surplus available, and the price of the shares, at 90s, is 3s 9d up since a week ago.

A.E.I. and the C.I.C.

For the present, at least, A.E.I. has been frustrated in its intention to give its employees an opportunity to participate in the ordinary capital through an offer of some 700,000 shares at a price of £2 per share. Liability to income tax would have arisen on the difference between that figure and the market price. This proposal had secured the approval of the Capital Issues Committee, which refused, however, an application to issue a million shares to ordinary stockholders on precisely the same terms. In the circumstances, the company is postponing action in both cases for the time being. Proposals affecting the 8 per cent preference shares are, however, to go forward.

Company News

Telegraph Condenser shares are a good market at 35s. The company has raised the dividend from 15 to 20 per cent and proposes, in addition, to distribute 100,000 new ordinary as a separate bonus, giving one new share for three old shares held. The trading profits have risen from £163,000 to £330,000 and the dividend is unusually well covered.

Full accounts available now from Aberdare Cables confirm that group profits for the year ended last October came out lower than those of the previous record figures. At a little over £100,000, they cover approximately, however, twice the cost of the 20 per cent ordinary dividend.

Wolf Electric Tools

Dealings began last week in the 5s ordinary shares of Wolf Electric Tools (Holdings). Particulars of the company were advertised earlier, as a preliminary to the placing of part of the £318,395 issued ordinary capital, in addition to which there is a small amount of preference stock. Shares changed hands initially at around 7s 3d. On the assumption that profits during the current year will be up to the average of £180,000 for the past three years, the directors anticipate a dividend at the annual rate of 7½ per cent. This would evidently represent a strictly conservative distribution, and would show a yield of just under 5¼ per cent at 7s 3d. Rearmament is expected to increase demands for the company's products.

Brook Motors

Another newcomer to the Stock Exchange lists was due to appear this week with the introduction of the 10s ordinary and 5 per cent preference shares of Brook Motors, Ltd. Ordinary capital in issue is £428,000, of which a part was expected to be made available in the market at around 32s 6d per share. Prospectus figures showed average profits of £256,000 for the past ten years. For the latest year, ended last September, profits showed a reduction to £206,000, explained by a policy of price reductions. Prices have since risen, and the directors expect the next results to show a substantial expansion. In that event, they anticipate a total ordinary dividend of at least 17½ per cent. A 5 per cent interim has already been declared; the indicated yield is around 5½ per cent. In this case also, the importance of the products in rearmament and export is expected to obviate raw material difficulties.

ELECTRICITY SUPPLY

Power Plant Contracts

New East Midlands Tariff

DURING the past month the British Electricity Authority has placed contracts for equipment for power stations, transforming stations and transmission lines amounting in the aggregate to £2,970,255. They include the following :—

Hackney power station : Main foundations.—J. L. Keir & Co., Ltd. Coal handling plant.—Mitchell Engineering, Ltd. West Ham "B" power station : Superstructure extensions and workshop foundations.—Taylor Woodrow Construction, Ltd. Rye House power station, Herts : Reinforced concrete framework, walls, foundations, etc., for 33 kV outdoor switchgear.—Bierrum & Partners, Ltd. Drakelow power station, near Burton-on-Trent : Auxiliary switchgear and accessories.—A. Reyrolle & Co., Ltd. Coal handling plant.—Mitchell Engineering, Ltd. Fleetwood power station, Lancs : Structural steelwork.—Edward Wood & Co., Ltd. Coal handling plant.—Simon-Carves, Ltd. Carrington power station, nr. Manchester : Auxiliary buildings.—W. J. R. Watson, Ltd. Bold power station, nr. St. Helens, Lancs : High pressure pipework.—Aiton & Co., Ltd. Roosecote power station, Barrow-in-Furness : High pressure pipework.—Aiton & Co., Ltd. Warrington power station : One 30,000 kW turbo-alternator, condensing and feed heating plant.—Brush Electrical Engineering Co., Ltd. Braehead power station, nr. Glasgow : One 50,000 kW turbo-alternator.—C. A. Parsons & Co., Ltd. Carmarthen Bay-Carmarthen-Haverford West : 132 kV overhead lines.—British Insulated Callender's Construction Co., Ltd.

Standard Domestic Tariff

The East Midlands Electricity Board announces that a new standard domestic tariff will come into operation in its Area from the first normal meter readings after 1st October next. It will be of the block type with charges of 4d and ¾d. The first block at 4d will be determined as follows : Three rooms or fewer, 30 kWh per quarter ; each additional room, 9 kWh per quarter. Thereafter consumption will be charged at ¾d per kWh. No rentals will be charged for meters installed by the Board for its own purposes but consumers will be required to pay for those provided for their own convenience. Any discount at present allowed for supplies to private dwellings will be discontinued under the new tariff. It is estimated that, over all, the revenue should not be greater than under the tariffs at present in force. With regard to the different classes of consumers, those on a flat rate should benefit, particularly those of the lower income groups who take supplies through prepayment meters. For two-part tariff consumers, except where existing fixed charges are high, there will be a slight increase.

Supplies to Estates

Among a number of new housing estates to which the South West Scotland Electricity Board is engaged in taking an electricity supply is that at Cranhill, Carntyne. Already 750 houses there have a supply and the Board has now approved a scheme costing £46,000 to supply a further 1,400 houses. Another large estate on which the Board is at present laying a new distribution network is at Milton, Glasgow, where 3,000 houses are being built. Over 1,300 houses are already served and the Board has approved expenditure amounting to £44,000 in supplying a further 1,298 houses.

Kirkwall Ceremony

The North of Scotland Hydro-Electric Board's new diesel engine station at Kirkwall, Orkney, the largest diesel generating station for public supply in Britain, will be opened on 15th May by Mrs. Arthur Woodburn, wife of the former Secretary of State for Scotland. The power station is an impressive building of native Orkney stone, the finish being similar to the traditional finish of most of the houses in Orkney technically described as "random rubble," a name which quite fails to convey its merit and attractiveness. The station has been built on land reclaimed from the Peerie Sea, a land-locked bay at Kirkwall. The initial installation comprises three 1,540 h.p. diesel engines made by British Polar Engines, each driving a 1,000 kW Bruce Peebles alternator, and an 800 h.p. Crossley diesel engine driving a 520 kW Bruce Peebles alternator. The ultimate capacity will be 7,000 kW.

Malvern Line Inquiry

Last week Mr. A. N. East conducted a public inquiry, on behalf of the Ministry of Fuel and Power, into the proposal of the Midlands Electricity Board to erect a power line across the Malvern Hills. In the course of his evidence

Mr. G. F. Peirson, the Board's chief engineer, said that no fewer than six schemes had been considered. Mr. J. F. Bourke, representing the Board, said it was proposed to use wood poles for reasons of economy. The cost of erecting the line would be £8,500 as compared with £33,700 for an underground cable. Alderman W. S. Lewis, chairman of the Board, said that there would be twenty-five 30ft poles in the line. Opposition to the scheme came from the Malvern Hills Conservators, the Council for the Preservation of Rural England, the Worcestershire County Council, the National Trust and six other organizations.

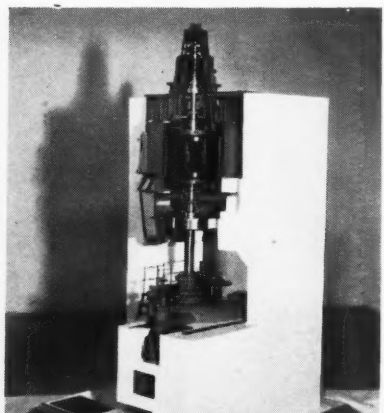
Colliers for B.E.A.

The Burntisland Shipbuilding Co., Ltd., has secured a contract to build three self-trimming colliers each of 4,600 tons deadweight for the British Electricity Authority. These vessels are to be built by an associated company, Hall, Russell & Co., Ltd., Aberdeen.

Model of Kiewa Generator

An interesting scale model of a large electric generator is a feature of the Metropolitan-Vickers stand at the North of Scotland Hydro-electric Board Exhibition at Dundee (10th to 14th April). The model is part-sectioned and represents a 17,100 kVA, 600 r.p.m. water-turbine driven a.c. generator, four of which are being manufactured at the company's Trafford Park Works for the Kiewa hydro-electric scheme of the Victoria State Electricity Commission, Australia. Two similar "Metrovick" machines, but each rated at 17,778 kVA and driven by a Pelton wheel, are also in hand for Kiewa.

Scale model of a 17,100 kVA 600 r.p.m. "Metrovick" water-wheel generator for Kiewa, Australia



New Scottish Service Centre

Miss Margaret M. Herbison, Joint Under-Secretary of State for Scotland, opened a new service centre for the South West Scotland Electricity Board on 30th March at Shotts, Lanarkshire. The chairman of the Board, Mr. J. S. Pickles, after welcoming Miss Herbison, explained that it was part of the Board's policy to improve the service centre facilities throughout the Area, particularly in the more isolated districts such as Shotts. He mentioned that since vesting date the number of service centres in the Board's Area had been increased by nearly 50 per cent.

Rural Supplies

Penrith Rural District Council has asked the North Western Electricity Board to speed up the supply of electricity to the rural area. The Council has pointed out that in the parish of Ainstable of 100 houses only three have electricity, and an extension of the line of less than a mile would be needed to supply the parish.

Houses for Power Station Workers

In a report to Portishead Council it was stated that the British Electricity Authority estimated that the first section of Portishead "B" power station would be in commission by 1st October, 1954, with further sections in 1955–7 and final completion in 1960 or 1961. For the first section the number of key workers would be 188 and it was estimated that 103 houses would be needed by the end of 1954. With regard to the cost of building, the Council pointed out that it could hardly be called upon to provide a rate contribution for a large number of houses when it obtained no benefit from the station by way of rateable value.

Canadian Aluminium Project

An agreement between the British Columbia Government and the Aluminum Co. of Canada for construction of an aluminium plant to cost $500 million has been submitted to the provincial legislature. Under the agreement the company will pay an annual fee of some $225,000 a year for hydro-electric power. Construction must start before 1st June, 1953.

The plant, capable of producing 300,000 tons of aluminium ingots a year, would be built near Kitimat and water power would come from the Nechako River area, east of Kitimat. One of the main difficulties faced is construction of a 50-mile power transmission line between the dam site and Kitimat. Studies of the proposed route, which crosses a 6,000ft mountain range, were made this winter.

NEW BOOKS

Industrial Polishing of Metals. By Gerald F. Weill. 202 pages. Published for *Metal Industry* by Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 21s.

This work, written by a specialist in the polishing industry, surveys the development of polishing from early times to the present day. A theoretical chapter explains the scientific aspects of polished surfaces and sets out methods of measuring the degree of polish on any given surface. The various procedures required for polishing many different kinds of metal articles are given in detail, and there is a full description of all the tools and materials of the polishing shop. The techniques of automatic and barrel polishing are treated at length, as also is that of electrolytic polishing. Other chapters deal with methods of avoiding or overcoming defects, the extraction of metal dust and other health and safety precautions, and the costing of polishing work.—J. C.

Antenna Theory and Design, Vol. II. Electrical Design of Antennæ. By H. Paul Williams. Pp. 522; figs. and index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 63s.

A considerable amount of data covering every aspect of the design of aerials, from the long wave to the micro-wave range, is contained in this book. A notable feature is the large number of graphs and curves, prepared for use in the actual design of aerial systems. A brief survey of antennæ and propagation, including the effect of the earth and the influence of the ionosphere, is followed by a detailed and well-written chapter on long and medium wave antennæ, special attention being given to the various approximate ways of estimating the base impedance. Polar diagrams, with the usual assumption of sinusoidal currents, are also treated.

Chapter three on short wave aerials deals largely with the many aspects of the half-wave dipole, while the next chapter, on micro-wave antennæ contains, in addition to the more common aperture radiators, much useful data on slots, corner-reflectors, and on the half-wave dipole and its variations. The lens antenna of Kock and others, however, is not dealt with.

Chapter six on directional antennæ and arrays is concerned mainly with short wave aerials, the rhombic aerial being considered in some detail.

Direction finding aerials, propagation conditions, and other general aspects receive full attention, and the book ends with a chapter on the transmission line, a topic which might, with advantage, have been placed earlier.

In general the subject is well treated, though the book has its quota of errors and loose ends. It is illustrated with a number of fine photographs of different types of aerials, especially the long wave aerials. A very full bibliography is appended for the benefit of those wishing to pursue specific aspects more fully.—L. L.

Books Received

Electrical Engineers' Reference Book 1951. General Editor, E. Molloy. 32 sections; figs. and index. George Newnes & Sons, Ltd., Tower House, Southampton Street, London, W.C.2. Price 50s.

Practical Wireless Encyclopædia. Twelfth Edition. By F. J. Camm. Pp. 360; figs. 554. George Newnes & Co., Ltd. Price 21s.

Electrical Engineers' Handbook. Edited by Harold Pender and Knox McIlwain. 23 sections; figs.; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 68s.

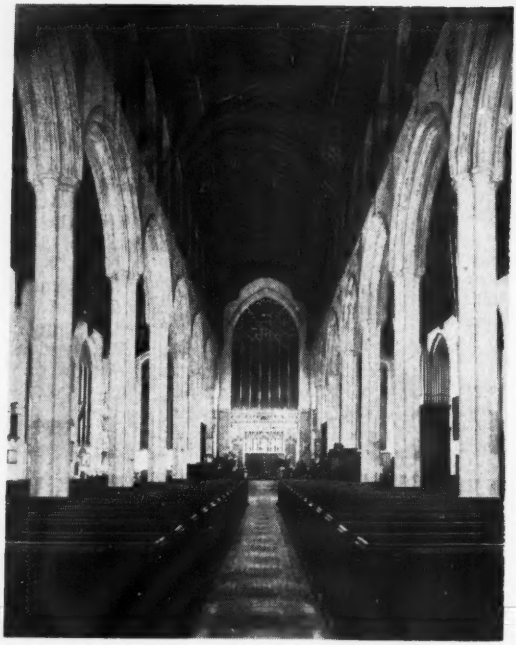
Practical Engineer Pocket Book 1951. Edited by N. P. W. Moore. Pp. 744; figs. and index. Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, London, W.C.2. Price 8s 6d.

Electrical and Radio Dictionary. Fourth edition. By Carl H. Dunlap, Enno R. Haan and L. O. Gorder. Pp. 133. The Technical Press, Ltd., Gloucester Road, Kingston Hill, Surrey. Price 14s.

Electric Clocks. Second edition. By S. J. Wise. Pp. 168; figs. and index. Heywood & Co., Ltd., Drury House, Russell Street, London, W.C.2. Price 12s 6d.

Electromagnetic Problems of Microwave Theory. By H. Motz. Pp. 182; index; figs. Methuen & Co., Ltd., 36, Essex Street, London, W.C.2. Price 9s 6d.

Quartz Vibrators. By P. Vigoureux and C. F. Booth. Pp. 364; figs; index. H.M. Stationery Office, York House, Kingsway, London, W.C.2. Price 30s.



Church Lighting

St. Peter Mancroft at Norwich

By G. C. JONES*

Registered Lighting Engineer (I.E.S.)

CONTRARY to the feeling which prevails in some sections of the architectural profession and ecclesiastical bodies that the fluorescent lamp is unsuitable for the improvement of church lighting, this form of source has been successfully employed in the church of St. Peter Mancroft at Norwich.

When first faced with the task of advising on the methods to be employed in relighting this 15th century building with fluorescent lamps, one of the principal considerations was the concealment of the lamps from the view of the congregation. When trying to employ straight lamps in a building having such grand architectural qualities, it is not an easy task to fit something which is so obviously modern into a medieval building.

Having decided therefore that the lamps were to be concealed from the view of the congregation when seated, the question arose as to where they should be mounted. The general view of the nave from the west (above) will leave the reader in no doubt that the desired effect has been attained. To provide a normal level of illumination and also to reduce the total number of points it was decided to employ 8ft 125 W "Osram" fluorescent lamps. In general they have been mounted in the flutes of the columns, accommodated in channel fittings which were specially designed to fit the curved contour, so that the lamps do not protrude and be visible to the congregation, yet provide the maximum all-round distribution of light. The instant-start control gear for each pair of lamps is housed in specially designed metal boxes mounted between the arches in the aisles at approximately 25ft above floor level. Like the fittings, they are finished to match the stonework and in consequence are unobtrusive.

In the area occupied by the nave and aisles, two lamps have been fixed to each column, mounted 12ft above floor level to the bottom of the fitting. One lamp provides light for the aisle and the other for the nave which, coupled with its opposite number on the other side of the nave, produces a reasonably even illumination over the entire area. A total of twelve

*Illuminating Engineering Dept., General Electric Co., Ltd.

125 W 8ft lamps have been used in the nave and six in each of the north and south isles. The average value of illumination achieved in the nave was approximately 3 lm/sq ft and in the picture the roof of the building does not appear unduly dark as that it is now seen at night as perhaps has never been seen before. It should be emphasized, however, that there are no other lights whatsoever in the nave, the whole effect being produced by the lamps on the columns.

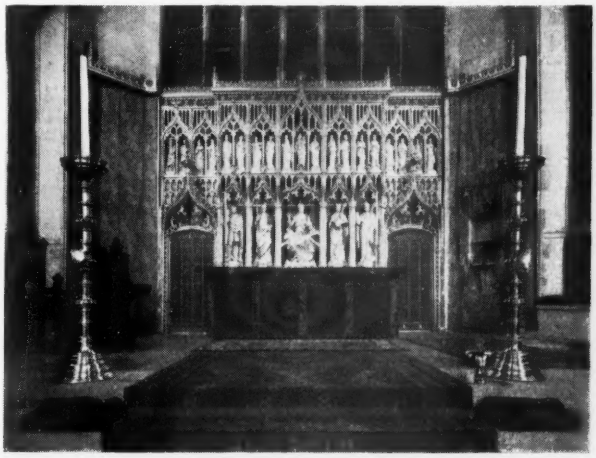
Chancel Illumination

The method of concealing lamps in the columns has been continued where possible in the chancel. Two channel fittings have also been fixed in the two side windows adjacent to the high altar and, in addition, two 200 W tungsten filament lamps accommodated in silvered glass "Gecoray" reflectors have been mounted above each. It was felt that it would be advantageous to have a proportion of directional light on the gilded reredos in order not to confuse the shape of the carvings. The picture below shows that incorporation of tungsten filament lamps with fluorescent lamps proved worth while. Of the four reflectors employed, two are used to light the vertical surface and the remaining two the horizontal surface, thus providing an increased level of illumination in the vicinity of the high altar, which is a desirable feature of any church installation. A further consideration is that a light source contained in a specular reflector assists in maintaining the shape and form of the highly polished altar furnishings which could easily be lost by the sole use of a diffused light source.

The Jesus Chapel (north aisle) and St. Anne Chapel (south aisle) are lighted in a similar manner by fluorescent lamps, fixed where possible in the columns and windows. Two 200 W tungsten filament lamps in similar reflectors are also used in each chapel for the same reasons as those described in the case of the chancel.

The font, which dates from 1463 and stands at the west end of the north aisle, is also illuminated by a fluorescent lamp mounted in the flute of a nearby column. It will be appreciated that if fittings were not provided on both sides of the first columns, the space between them and the west wall would have to rely entirely upon reflection for illumination. Fittings have thus been installed on four sides of the first columns on each side of the nave, one of which is admirably placed to illuminate the font. The architectural qualities of the carving are now visible in such a manner that all can appreciate its magnificence. The tapestry towards the back of the font is also clearly seen, which proves that the fluorescent lamp close by is serving a most useful purpose and helping all who are interested in church architecture to appreciate the true beauties which are so often unseen in many churches having considerable architectural qualities.

The success of the relighting of the church is in great measure due to the assistance and co-operation received from the Eastern Electricity Board which was responsible for carrying out the wiring installation.



Combined fluorescent and filament illumination of the high altar

AUSTRALIAN ELECTRICAL TRADE

Detailed Statistics for 1948–49

THE Australian import and export trade returns by countries of origin and destination for 1948–49 have now been issued. They are fully detailed ; this fact no doubt explains their rather belated appearance. Some of the leading electrical import items are shown in the accompanying table, with notes of increases or decreases compared with 1947–48. The total value of £A187,000 compared with £A195,000 in 1947–48; radio transmitting sets £A164,000 (£A105,000); radio parts £A100,000 (£A40,000); dry batteries and cells £A155,000 (£A128,000); storage batteries and parts £A128,000 (£A56,000); and regulating, controlling and starting apparatus £A68,000 (£A54,000). Electrical machinery exports were not important. They consisted

PRINCIPAL IMPORTS

Class of Goods	1948–49 £A(000)	Inc. or dec. on 1947–48 £A(000)	Class of Goods	1948–49 £A(000)	Inc. or dec. on 1947–48 £A(000)
A.C. generator sets	13	— 60	Lamps, filament, automobile	190	+ 91
D.C. generator sets	49	— 1	*From U.K.*	90	+ 55
Alternators for turbines	400*	+ 250	„ *Holland*	47	+ 29
Other alternators	235*	+ 177	Lamps under 20 V flashlight	38	+ 19
Generators for turbines	13	— 3	Other lamps under 20 V	83	+ 27
Other generators	111	+ 46	Lamps 20 V and over gas-filled	32	+ 5
From U.K.	60	+ 35	Lamps 20 V and over m.f.	57	+ 25
„ *Canada*	10	+ 9	Mercury vapour, etc., tubes	71	— 32
Other current generating machines	21	+ 12	Heating and cooking appliances:		
Motors under 1 h.p. except as parts of machines	1,311	+ 685	Stoves, cookers and the like	835*	+ 450
From U.K.	1,080	+ 774	Radiators, toasters and kettles	88*	+ 9
„ *U.S.A.*	70	— 80	Measuring and recording instruments	324	+ 103
Motors 1 h.p. and over, a.c. induction (non-commutator) type	963	+ 427	*From U.K.*	253	+ 105
From U.K.	755	+ 320	„ *U.S.A.*	51	— 6
„ *U.S.A.*	95	+ 35	Telegraph instruments and appliances	209	+ 104
Ditto, other	169*	+ 104	*From U.K.*	118	+ 109
D.c. motors	129*	— 29	„ *U.S.A.*	90	— 6
Convertors, frequency changers and rotary transformers	9	— 136	Telephones	751*	+ 339
Light and power cable, lead-covered and lead armoured, paper insulated	861*	+ 406	Telephone switchboards, automatic	399*	+ 300
Ditto, otherwise insulated	321*	+ 157	Telephone and telegraph switchboards and appliances, n.e.i.	2,116*	+ 1,364
Other covered light and power cable	467*	+ 168	Radio valves	305	— 101
Telegraph and telephone cable and wire lead covered and lead armoured and covered	1,329*	+ 943	Radio receiving sets	62	— 2
Other covered telegraph and telephone cable and wire	161*	— 13	Transmitting sets	20	— 28
			Radio parts	136	+ 14

* Wholly or mainly from U.K.

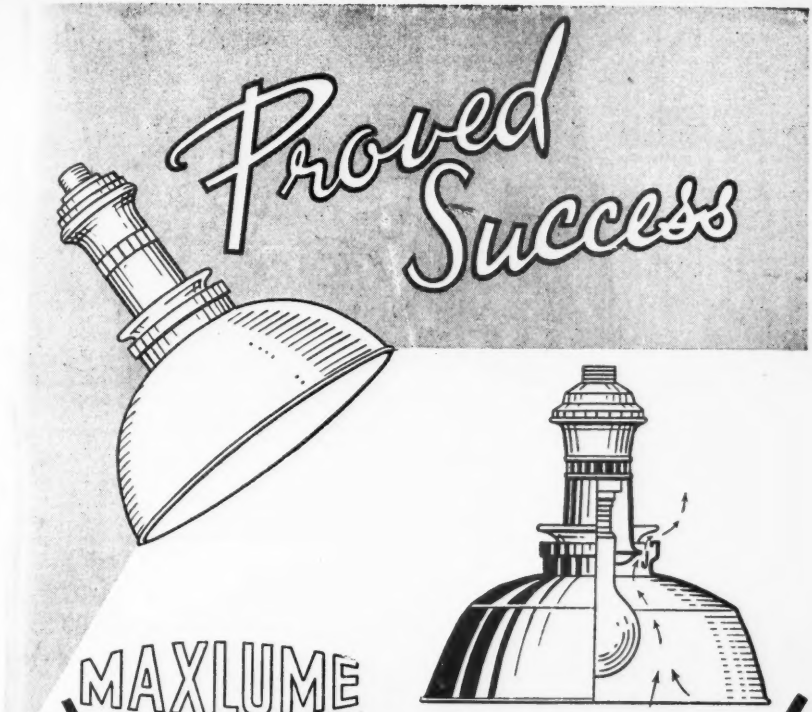
value of electrical imports was £A17,200,000 in 1948–49 compared with £A10,300,000 in 1947–48. There were specially noteworthy increases in alternators, motors, cables, telephone material, and heating and cooking appliances. On the other hand trade in radio goods declined. The United Kingdom did the major part of the business, with the United States some way behind as second, and Canada and Holland represented in some sections.

Electrical Exports

In Australia's electrical export trade in 1948–49, which amounted in value to £A1,275,000 (Commonwealth goods only, i.e., excluding re-exports), specially noteworthy items were covered cable and wire to the largely of dynamos and motors for motor vehicles and cycles. New Zealand was the biggest customer. Other noteworthy outlets were Malaya, Hong Kong, New Guinea, Indonesia and South Africa.

Welding Summer School

THE British Welding Research Association is holding a summer school on " Welding Design and Engineering " at Ashorne Hill, near Leamington Spa, from 25th May to 2nd June. Employers who wish to send members of their staff to the school, or individuals who wish to attend, should communicate with the Secretary, 29, Park Crescent, London, W.1.



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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1951. Standard Telephones & Cables, Ltd., Feldhusen, [illegible] and Secker, B.—Electrical measuring devices. [illegible] October, 1947. (653617.)

1947

6215. Igranic Electric Co., Ltd.—High-frequency [illegible]netric heating of sheet material. 17th April, 1947. (653794.)

7138. Standard Telephones & Cables, Ltd., and [illegible]ds, P. A.—Electrical counting equipment. 23rd April, 1948. (653618.)

7083. British Thomson-Houston Co., Ltd.—Automatic control systems for electric motors. 27th May, 1947. (653620.)

7365. Marconi's Wireless Telegraph Co., Ltd., [illegible]erata, R., and Gillam, C. L. J.—Radio aerials. 8th July, 1948. (653621.)

8815. Igranic Electric Co., Ltd.—Electrical contacts and contact materials and methods of making same. 14th July, 1947. (653796.)

8680. A. C. Cossor, Ltd., and Allen, A.—Radio navigation systems. 1st October, 1948. (653801.)

50127. Igranic Electric Co., Ltd.—Control for alternating current motors. 12th November, 1947. (653805.)

1655. Tesla, Electrical & Radio Industry, National Corporation.—Polyphase generator of the thermionic type. 30th December, 1947. (653815.)

1948

522. British Thomson-Houston Co., Ltd., and Veale, R. H.—High voltage electric gas-blast circuit-breakers. 22nd December, 1948. (653630.)

684. Radio Corporation of America.—Electron-beam control apparatus. 8th January, 1948. (653631.)

3974. Birnie, R. C., and Buchan, S. D. F.—Telephone systems. 18th February, 1949. (653639.)

4222. Hoover, Ltd., and Bell, W. C.—Electric suction cleaners and the like. 11th February, 1949. (653640.)

4286. British Thomson-Houston Co., Ltd.—Magnetically-operated valves. 13th February, 1948. (653747.)

4928. British Thomson-Houston Co., Ltd.—Temperature control devices for electric blankets. 19th February, 1948. (653641.)

4956. Bendix Aviation Corporation.—Electric pulse-time modulator. 19th February, 1948. (653824.)

5713. Standard Telephones & Cables, Ltd.—Electromagnetic clutch-operating mechanism for use for instance for automatic telephone switches. 26th February, 1948. (653825.)

5970. Director of the Office of Technical Services, Department of Commerce.—Ultra-high-frequency oscillators. 27th February, 1948. (653646.)

5984. Director of the Office of Technical Services, Department of Commerce.—Magnetrons. 27th February, 1948. (653750.)

6557. English Electric Co., Ltd., Jones, E., and Young, J. B.—Electric insulating materials. 24th February, 1949. (653647.)

7110. Brush Development Co.—Magnetic transducing apparatus. 8th March, 1948. (653649.)

7844. Pye, Ltd., and Hughes, D. H.—Noise-suppression circuits in radio receivers. 11th March, 1949. (653652.)

10367. Soc. Electro Mecanique de l'Aveyron.—Electric brakes. 14th April, 1948. (653758.)

12363. W. T. Henley's Telegraph Works Co., Ltd., Hoban, H. C., and Maxwell-Holroyd, S.—Production of identification markings on electric conductors. 26th April, 1949. (653685.)

13793. Standard Telephones & Cables, Ltd.—Combined drive and clutch particularly for a selector switch. 21st May, 1948. (653664.)

18363. Dorman & Smith, Ltd., and Astbury, A. R.—Electric fuse elements. 3rd December, 1948. (653671.)

18429. Telephone Manufacturing Co., Ltd., and Saraga, W.—Wave transmission networks. 7th July, 1949. (653696.)

18552. S. Smith & Sons (England), Ltd., and Russell-V. J. S.—Instruments or display devices having markings rendered fluorescent by invisible light rays. 2nd June, 1949. (653672.)

19333. General Electric Co., Ltd., and Nixon, R. D.—Cathode-ray tube picture transmitters and electrical circuits associated therewith. 19th July, 1949. (653700.)

20078. General Electric Co., Ltd., and Bryden, J. E.—Electrical phase or frequency discriminators. 13th June, 1949. (653703.)

21286. Philips Electrical, Ltd.—Electric discharge tubes comprising an indirectly heated cathode. 12th August, 1948. (653707.)

22975. Oliver, S. J.—Kilns for drying hops and the like having electric warning means. 31st August, 1948. (653776.)

23711. Johnson, W. T., and MacLaren, H. D.—Telephone communication systems. 9th September, 1948. (653713.)

24407. Pye, Ltd., and Court, P. R. J.—Apparatus incorporating a cathode-ray device, particularly television receivers. 9th September, 1949. (653778.)

24419. Chloride Electrical Storage Co., Ltd., Gray, R., and Wellens, J.—Vent plugs for electric accumulators. 7th September, 1949. (653770.)

25620. Philips Electrical, Ltd.—Overload release clutch mechanism and electrically-driven apparatus comprising a plurality of such mechanisms. 1st October, 1948. (653762.)

25696. Seismograph Service Corporation.—Radio survey system. 1st October, 1948. (653784.)

27712. Hazeltine Corporation.—Automatic control systems for television receivers. 25th October, 1948. (653788.)

27720. English Electric Co., Ltd., and Allan, N. F.—Electric discharge devices. 21st October, 1949. (653830.)

28828. Noyes, R. C. (Compagnie Générale du Duralumin et du Cuivre).—High voltage power transmission cables. 5th November, 1948. (653719.)

1950

5155. Pirelli Soc. Per Azioni.—Tanks or reservoirs for feeding oil or fluid insulating compound to electric cables. 1st March, 1950. (653729.)

23262. Chloride Electrical Storage Co., Ltd., Gray, R., and Wellens, J.—Vent plugs for electric accumulators. 7th September, 1949. (653731.)

Amended Specifications

635900. Western Electric Co., Inc.—Wave guide switch.

641164. British Thomson-Houston Co., Ltd.—Pulse-echo systems.

NEXT WEEK'S EVENTS

Monday, 16th April

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "Public Lighting," opened by E. H. Jesty.

Tuesday, 17th April

BIRMINGHAM.—James Watt Institute, 6.30 p.m. I.E.E. South Midland Education Discussion Circle. Discussion on "Unit Systems with particular reference to the Rationalized M.K.S. System," opened by L. H. Carr and Dr. W. G. Thompson.

GLASGOW.—At the Institution of Engineers & Shipbuilders, 39, Elmbank Crescent, 7 p.m. I.E.E. Scottish Centre. "A Review of Research in Electricity Supply," by C. W. Marshall.

LEEDS.—At the Lighting Service Bureau, Aire Street, 6.30 p.m. I.E.E. North Midland Utilization Group. "The Dimming of Low-Pressure Discharge Lamps," by C. E. Williams.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurements Section. Discussion on "Humidity Measurement and Control," opened by Dr. L. Hartshorn and Prof. H. S. Gregory.

Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6.30 p.m. Association of Supervising Electrical Engineers. "Telecommunications and Control Systems," by T. H. Flowers.

RUGBY.—E.M.E.B., Little Church Street, 6.30 p.m. I.E.E. Rugby Sub-Centre Students' Section. "Electronic Printing Press Drives," by P. R. J. French.

Wednesday, 18th April

LANCASTER.—N.W.E.B., North Road, 7 p.m. I.E.E. North Lancashire Sub-Centre. "Electrically Interlocked Guards on Machines," by W. Fordham Cooper.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. "The Protection of Electrical Power Systems: A Critical Review of Present-day Practice and Recent Progress," by H. Leyburn and C. H. W. Lackey.

Savoy Place, W.C.2, 2.30 p.m. Joint meeting of the Royal Society of Arts and the Institution of Electrical Engineers. Llewelyn B. Atkinson Lecture. "The Electricity Supply Position," by Sir John Hacking.

Waterloo Bridge House, 5 p.m. Institution of Post Office Electrical Engineers. Informal meeting. "Training for Management," by D. G. Dafforn.

SHEFFIELD.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. "The Measurement of Light and Colour," by G. T. Winch.

SOUTHAMPTON.—University College, 6.30 p.m. I.E.E. Southern Centre. Annual general meeting. Discussion on "Domestic Appliances," opened by P. Honey.

Thursday, 19th April

BRIDGEND (GLAM.).—Llynfi Power Station, 6 p.m. Association of Mining Electrical & Mechanical Engineers, South Wales Branch. "Earthing in Relation to Shock Accidents," by A. Johnston.

COVENTRY.—G.E.C. Telephone Works, 7 p.m. I.E.E. South Midland Students' Section. "Design for a Radio Controlled Destroyer," by I. A. McCord.

DUBLIN.—42, James's Street, 6 p.m. I.E.E. Irish Branch. Annual general meeting.

LONDON.—Connaught Rooms, W.C.2, 12.30 for 1 p.m. Diesel Engine Users' Association. Annual luncheon.

Friday, 20th April

BIRMINGHAM.—Imperial Hotel, 6 p.m. I.E.S. Birmingham Centre. Discussion on "Street Lighting," opened by E. Stroud and P. C. Sugg.

HARROGATE.—Grand Hotel, 7.30 for 8 p.m. I.E.E. North Midland Centre. Annual dinner-dance.

LONDON.—Palmerston Restaurant, Bishopsgate, E.C.2, 6 for 6.45 p.m. E.P.E.A. Southern Meter Engineers' Technical Group. Annual dinner.

39, Victoria Street, S.W.1, 6.30 p.m. Junior Institution of Engineers. "Aluminium as an Engineering Material," by Dr. E. G. West.

NEWCASTLE-ON-TYNE.—King's College, 6.30 p.m. I.E.E. North Eastern Students' Section. Annual general meeting and film show.

Saturday, 21st April

BRADFORD.—Y.E.B. Offices, Sunbridge Road, 2.30 p.m. I.E.E. North Midland Students' Section. "Electric Safety," by T. J. Wynn.

Report on Costa Rica

ELECTRICAL matters do not occupy much of a recent report on Costa Rica by Mr. B. P. Sullivan, H.M. Minister at St. José (H.M. Stationery Office, 1s 3d). All the electric power produced is hydro-electric and the plant is fully loaded. A scheme is under consideration for the erection of power plant on the Raventazón River and any expansion of industry is dependent upon this or some alternative scheme. The supply of light and power in general is in the hands of a United States concern which also runs the telephone system. The Government owns an electric railway connecting the capital with the Pacific port of Puntarenas but this is said to be running at a loss and in need of renovation.

Industry is on a small scale; in a list of industrial products it is shown that 100 electric stoves are produced monthly—there are no other electrical items. The United States predominates in the import trade. An appendix gives the following figures in United States dollars for electrical items imported during 1948 (the latest available):—Electrical equipment $185,600; generating machinery $273,100; electric refrigerators and parts $223,400; and other electrical machinery and apparatus $1,654,000.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our Official Notices" section, the date of the issue is given in parentheses.

Australia.—SYDNEY.—31st May. City Council. Metalclad switchgear for Auburn Substation. C.R.E. (I.B.) 57207/51. Ten/2278.)*

Bath.—25th April. Education Committee. Electrical installation at 13-14, Somerset Place. E. N. Irens, consulting engineer, Haycroft House, Filton, Bristol.

Belfast.—26th May. Electricity Department. Air-blast small-oil-volume indoor switchgear. (See this issue.)

27th April. Street lighting remote control equipment and switchgear. (See this issue.)

Edinburgh.—North of Scotland Hydro-Electric Board. Supply and erection of approximately twenty miles of 33 kV overhead transmission line between Balthayock and Blairgowrie. (See this issue.)

New Zealand.—WELLINGTON.—26th April. Carbon resistors and condensers. (C.R.E. (I.B.) 57623/51. Ten/2292.)*

Sunderland.—11th May. Education Authority. Electrical installation at Pennywell East Primary Schools. (See this issue.)

Thailand.—BANGKOK.—7th May. Department of Transport, Ministry of Communications. Diesel electric power plant of 3×500 kW capacity for the Port of Bangkok. (C.R.E. (I.B.) 57571/51. Ten/2285.)*

Uruguay.—MONTEVIDEO.—16th May. Usinas Electricas y Telefonos del Estado. Ten 50 kW generating sets. (C.R.E. (I.B.) 57452/51. Ten/2288.)*

29th June. Administracion Municipal de Transportes Colectivos de Montevideo. Supply and installation of a network of trolley-buses for the City of Montevideo, including trolley-buses, rectifier stations, underground cable, overhead line equipment, steel poles, copper wire and copper cable. (C.R.E. (I.B.) 56160/50. Ten/2275.)*

30th April. Direccion General de Communicaciones (Servicio de Transmissiones). Telegraph switches and keys. (C.R.E. (I.B.) 55955/51. Ten/2283.)*

Wortley.—24th April. R.D.C. Wiring and fittings in 65 houses (first section of scheme for wiring 1,300 houses). Surveyor, Council Offices, Grenoside, Sheffield.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

ORDERS PLACED

Coventry.—Corporation. Recommended. Electrical installations in flats, Fletchamstead Highway estate (£2,166).—Thompson Electrical Co., of Kenilworth.

Northumberland.—Education Committee. Electrical installations in schools:—Berwick Tweedmouth County Primary (£293).—Border Electrical Services, Ltd. Millfield Temporary County Primary (£446).—South East Scotland Electricity Board. Longbenton Westmoor County Primary (£498).—Bernard Berrie.

Torquay.—Corporation. Electrical installations 144 houses on Marldon Road estate (£5,950).—Havill & Williams.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alsager.—Houses (70), Close Lane scheme; G. F. Taylor, U.D.C. surveyor, 3, Lawton Road, Alsager, Stoke-on-Trent.

Amlwch (Anglesey).—Large factory for Associated Ethyl, Ltd.; Marples Ridgway & Partners, Ltd., 2, Lygon Place, London, S.W.1.

Bath.—Adaptations at Norfolk House and 1-7, Norfolk Crescent for school of building (£147,000); J. Owens, city engineer, Guildhall.

Bedford.—Flats (54), Ashburnham Road (£120,000); borough surveyor, Newnham House, Horne Lane.

Birkenhead.—Seven-storey technical college (£538,000); Lloyd & Cross, Ltd., 68 Argyle Street, Birkenhead.

Houses (130), Woodchurch estate (Contract 6); H. J. Rowse, architect, Martins Bank Buildings, Liverpool, 2

Boldon.—Houses (38), Lizard Lane; U.D.C. surveyor.

Bristol.—Showrooms and sales premises, Broadmead; F. W. Woolworth & Co., Ltd., 1, New Bond Street, W.1.

Chester.—Eleven shops and living accommodation, Blacon estate; city surveyor.

Chester-le-Street.—Houses (200) for miners at Beamish Mary, Handon Hold and Pelton pits; F. Bowman, R.D.C. housing architect.

Clayton-le-Moors.—Further 18 houses at Field Bottoms estate for U.D.C.; F. Bradley, architect, 4, Wood Street, Bolton.

Clitheroe.—Flats (44), Low Moor; borough surveyor.

Coventry.—Five-year scheme for 500 to 600 houses for miners, with 150 to 200 in immediate future; D. E. E. Gibson, city engineer, 11, Warwick Row.

Darlaston.—Houses (22) and 6 blocks of flats at Catherines Cross; U.D.C. surveyor.

Devonport.—Houses (208), Tavistock Road; St. Aubyn Estates, Chapel Street.

Dewsbury.—Houses (260), Chickenley Lane and Wakefield Road; borough engineer.

Doncaster.—Houses at Intake estate: Wright & Kidger Bros., 2, Church Lane (6 houses) and F. J. Flowitt (Building Contractors), Ltd., 34, Thorne Road (10 houses).

Gosforth (Northumberland).—Block of flats, Graham Park Road, for the U.D.C.; Cussins, Ltd., builders, Moor Court, Gosforth.

Great Yarmouth.—Two three-storey blocks of flats, Middlegate Street; borough surveyor.

Grimsby.—Secondary modern school for girls, Chelmsford Avenue; F. A. Would, Ltd., builders, Bourne Lane, Ladysmith Road.

Halifax.—First and second instalments of extensions to technical college; L. & W. Morrell, Ltd., Low Moor, Bradford.

Bus station, canteens, etc., Cross Field (£19,820); G. Holden, borough surveyor, Crossley Street.

Hemel Hempstead.—Factory premises; Multigraph-Addressograph, Ltd., Oxgate Lane, N.W.2.

Honiton.—Houses (25) and block of flats; A. Lamb, architect, Town Hall, Ottery St. Mary.

Kidderminster.—Houses (140); J. G. Stewart, borough engineer, 110, Mill Street.

Lancashire.—Adaptation of Astley Isolation Hospital as a day special school; county architect, Preston.

London.—Southwark.—Offices, shops and warehouse, Walworth Road, for Messrs. Boisom: Levinson & Partners, architects, 17, Dorset Square, N.W.1.

St. Johns Wood.—Four blocks of flats, Hamilton Terrace, for St. Marylebone B.C.; Culpin & Son, architects, 3, Southampton Place, W.C.1.

Londonderry.—General hospital (£1,000,000) for Northern Ireland Hospitals Authority; Yorke, Rosenburg & Mardall, architects, 2, Hyde Park Place, London, W.2

Maghull.—Erection of Ormonde Drive Secondary Modern School; Henry Boot & Sons, Ltd., Liverpool.

Maidstone.—Extensions to Poplar Eventide Homes, Tonbridge Road; Richardson & Buckley, Ltd., builders, 61, Park View Road, Sheffield.

Manchester.—Conversion of wards into pathology laboratory at Crumpsall Hospital; G. W. Dawson & Co., Lower Crumpsall.

Methwold.—Secondary modern school; Norfolk county architect, 25, Thorpe Road, Norwich.

Middlesbrough.—Houses (66) at Berwick Hills. Builders: P. Shannon (32 houses) and R. H. Bailey and Son (34 houses). Both local firms.

Dairy in Cargo Fleet Lane for M. L. Collier and Sons, Cargo Fleet, Middlesbrough.

New police headquarters, three storeys high and covering 20,000 sq. ft.; borough engineer.

Mitcham.—Dwellings (91). Ravensbury estate, Ravensbury Grove; R. H. White, town clerk, Town Hall.

Morley.—Houses (96), Asquith Avenue estate; M. H. Brook, housing director, Queen Street.

Newhaven.—Dwellings (20) and four shops with flats over, Meeching estate; surveyor, Urban Council Offices.

Northumberland.—New modern school at Longbenton Seaton Burn for the C.C.; Thomas Clements and Sons, Ltd., builders, Jesmond, Newcastle-on-Tyne.

Modern school, Ovington (£141,000); county architect, County Hall, Newcastle-on-Tyne.

Oldbury.—First portion of college of further education (£120,000) comprising workshop block, classroom and laboratory blocks, etc.; E. C. Harris & Partners, 3, Bedford Square, London, W.C.1.

Rawtenstall.—Omnibus station, Queen's Square; borough surveyor.

Ruislip-Northwood.—Houses (60), Castleton Road, Eastcote; surveyor, Urban Council Offices, Oaklands Gate, Northwood.

Seaham.—Houses, Westlea estate. Builders: Tomlin and Son, Seaham (20 houses) and J. Berriman, Fence Houses (20).

Shenley.—Nurses' home and additional ward blocks at Harperbury Hospital; H. C. Janes, Ltd., builders, 183, Hightown Road, Luton.

Southampton.—Rebuilding Scullards Hotel for Cooper & Co., Ltd.; B. Dale & Partners, architects, 41, The Avenue.

Southport.—Rebuilding home for blind babies; A. Crampton, architect, 35, York Road.

South Shields.—Block of 51 flats in Willington Street; J. Reid, borough engineer, Town Hall.

Houses (124), Simonside; L. W. Evans, Ltd., builders, 18, Norfolk Street, Sunderland.

Stalybridge.—Houses (40), Buckton Vale site; J. Ridyard & Sons, Ltd., Railway Sawmills, Ashton-under-Lyne.

Stourbridge.—Houses (61) and bungalows (12), Hodge Hill estate, Wollescote; Nathan Hyde (Sedgley), Ltd., 6, Claremont Road, Sedgley.

Sunderland.—Old people's hostel at Pennywell (£30,000); borough architect, Grange House, Stockton Road.

Taunton.—Two-storey laboratory, Musgrove Park Hospital, for Medical Research Council; Roberts Bros., Ltd., builders, Taunton Road, Bridgwater.

Tow Law (Co. Durham).—Houses (24) for the U.D.C.; J. W. Hanson and Son, architects, 123, Northumberland Street, Newcastle-on-Tyne.

Watford.—Factory, Lower High Street; H. H. Butterfield, Ltd., 55, Southeron Road.

Whitley Bay.—Houses (12), Foxhunters' site, for the U.D.C.; Rockcliffe Building Co., Ltd., builders, Park View, Whitley Bay.

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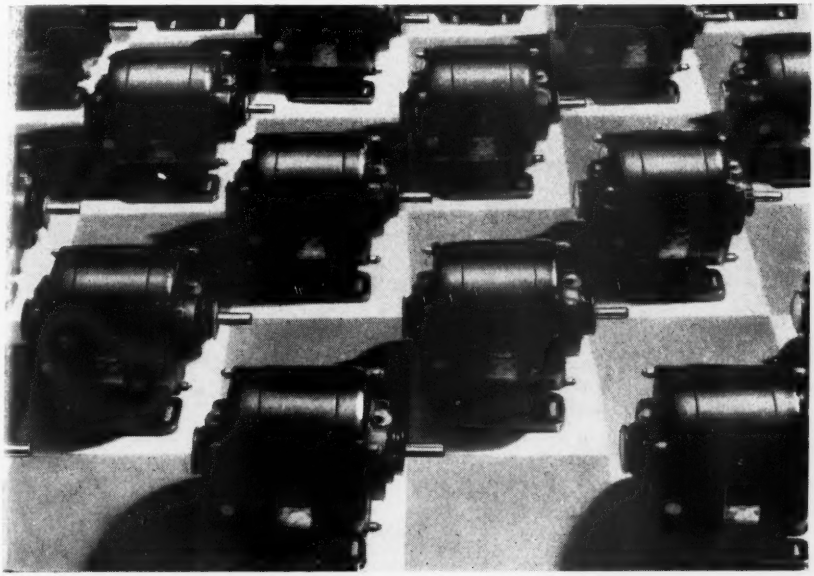

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THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C 2

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS are accepted up to **First Post on** Monday of the week of issue, and should be addressed to Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED advertisements are PREPAID at 3/- per line (approx. 7 words) per insertion. Where the advertisement includes a Box Number this counts as two words and there is an additional charge of 1/-.

DISPLAYED:—42/- per inch, per insertion. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

CITY OF BELFAST

Electricity Department

TENDERS are invited as under:—

INDOOR SWITCHGEAR.

The supply, delivery and erection of 33-kV, 1,500-MVA open type indoor switchgear of the airblast or small oil volume type.

Form of tender (No. N.1016), conditions and specification, in quadruplicate, may be obtained from Messrs. Merz & McLellan, Consulting Engineers, Carliol House, Newcastle-upon-Tyne, 1, on payment of a deposit of five guineas (cheques to be made payable to the Belfast Corporation Electricity Department), which deposit will be refunded provided a bona fide tender be lodged and not withdrawn. Extra copies of the contract documents may be obtained at three guineas per set, which sum will not be returnable.

Latest time for receipt of tenders, to be lodged in quadruplicate: 4 p.m. on Friday, 25th May, 1951.

CONTROL EQUIPMENTS AND CONTROL SWITCHES.

The supply and delivery of street lighting remote control equipments and control switches.

Form of tender and specification (No. G.162) may be obtained at the Electricity Department, East Bridge St., Belfast, on payment of a deposit of one guinea (cheques to be made payable to the Belfast Corporation Electricity Department), which deposit will be refunded provided a bona fide tender be lodged and not withdrawn. Extra copies may be obtained at half a guinea each, which sum will not be returnable.

Latest time for receipt of tenders: 4 p.m. on Friday, 27th April, 1951.

The following conditions apply to the above-mentioned tenders: Each tender, in sealed envelope marked "Tender for ——, Electricity Committee," and endorsed with the name and address of the tenderer, must reach the undersigned not later than the time specified.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered. The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast.
6th April, 1951. 1129

COUNTY BOROUGH OF SUNDERLAND LOCAL EDUCATION AUTHORITY

Pennywell East Primary Junior & Infants' Schools

TENDERS are invited for the Electrical Installation required in connection with the above-named proposal. Drawings, specification, conditions of contract and form of tender may be obtained from the Architects, Messrs. Wm. & T. R. Milburn, 17, Fawcett Street, Sunderland, on payment of a deposit of two guineas (cheques to be made payable to "Sunderland Corporation"), returnable on receipt of a bona fide tender.

Sealed tenders, endorsed on the outside "Tender for Electrical Installation, Pennywell East Primary Schools," must be addressed to the Town Clerk, Town Hall, Sunderland, and delivered not later than Friday, 11th May, 1951. The Council does not bind itself to accept the lowest or any tender.

G. S. McINTIRE,
Town Clerk and Clerk to the Local Education Authority.

Town Hall, Sunderland.
April, 1951. 1098

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

South Caledonia Area

33-kV Overhead Transmission Line

TENDERS are invited for the supply, delivery and erection of approximately twenty miles route length, single-circuit, steel-cored aluminium, wood-pole line between Balthayock and Blairgowrie, in the County of Perth.

Copies of the tender document may be obtained on or before Friday, 20th April, 1951, on application to the Engineers, Messrs. Kennedy & Donkin, 12, Caxton Street, London, S.W.1. Applications should be accompanied by a cheque for £1 1s., which will be returned on receipt of a bona fide tender.

The Board do not bind themselves to accept the lowest or any tender.

W. D. D. FENTON,
Secretary.

16, Rothesay Terrace, Edinburgh, 3.
3rd April, 1951. 1087

SITUATIONS VACANT

ELECTRICAL ENGINEER-MECHANIC FOR NAIROBI

WANTED for Nairobi a first-class electrical engineer-mechanic who has also specialised in armature winding. Age not to exceed 30 and preference given to an unmarried man. 4-year contract with excellent future prospects. Basic remuneration £750 a year with annual increments. Personal taxation low.

Apply with full particulars to Alex. Lawrie & Co. Ltd., 8/10, Brown's Buildings, St. Mary Axe, London, E.C.3.; all applications will be replied to. 1130

BRITISH ELECTRICITY AUTHORITY

South Wales Division

APPLICATIONS are invited for the appointment of DEPUTY POWER STATION SUPERINTENDENT, Roath Power Station, Cardiff, at a salary in accordance with the Revised National Joint Board Agreement, Class F, Grade 3, £827-£865 per annum).

Applicants should preferably be corporate members of the Institute of Mechanical or Electrical Engineers, and should have had wide experience in the operation, maintenance and administration of a Power Station with modern generating plant.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Scheme.

Forms of application may be obtained from the Divisional Secretary's Office at the address below to whom completed applications should be returned not later than 23rd April, 1951.

H. V. PUGH,
Divisional Controller.

Cardiff (Pengam Moors) Airport, Cardiff.
4th April, 1951. 1139

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

Commercial Department

SALESMEN, COMMERCIAL REFRIGERATION (35/51/N). Vacancies occur for Salesmen to specialise in commercial refrigeration equipment, operating from Sub-Area Headquarters at:—

(i) Norwich.
(ii) Stowmarket.

Applicants must be fully experienced in handling enquiries for all types of equipment, including food storage and milk cooling, and must be capable of initiating business and must have a proved sales record.

Salaries for these appointments will be in accordance with Grade 3 of the National Joint Council Salary Agreement, dated 23rd March, 1950 (£450 by £20 to £510 per annum).

Applications in writing, giving fullest particulars of training, experience, sales record and details of present employment and salary, should, according to the locality in which employment is preferred, be addressed to the Manager,

(i) Norfolk Sub-Area, Duke Street, Norwich;
(ii) Suffolk Sub-Area, Finborough Hall, Stowmarket.

Luton District

ASSISTANT DISTRICT COMMERCIAL ENGINEER (39/51/R). Applicants must have a good general and technical education, preferably Corporate Members of the Institution of Electrical Engineers, with particular experience in electrical contracting and maintenance work.

The selected applicant would be responsible to the District Commercial Engineer for commercial development, supervision of wiring installation work, including estimating all types of industrial, agricultural and domestic installations, and such general consumer advisory service as would be anticipated in a District having important industrial, agricultural and housing development. He would also be responsible for operating an efficient maintenance service.

The provisional salary for the appointment will be £675 per annum, but subject to modifications in accordance with the terms and conditions laid down from time to time by the appropriate negotiating bodies.

Applications in writing, giving details of age, qualifications, experience and details of present employment and salary, should be addressed to the District Manager, Eastern Electricity Board, Electricity Offices, St. Mary's Road, Luton.

Special Note.—In the case of this appointment applications must be received within seven days of the appearance of this advertisement.

Essex Sub-Area

THURROCK AND SOUTHEND DISTRICTS: DEMONSTRATORS (36/51/N). Applicants should have had a domestic science training including electrical housecraft, and should preferably hold the E.A.W. Certificate. They should be competent to plan and give cookery demonstrations, including lectures and advice to consumers on the utilisation of domestic appliances. Previous experience in an electricity service centre is desirable.

The salary will be within Grade I salary range, £310 to £390, of the National Joint Council Salary Agreement, dated the 23rd March, 1950.

Applications in writing, stating age, qualifications, experience and details of present employment and salary, should be addressed to:—

For the Thurrock District: The District Manager, Eastern Electricity Board, Maidstone Road, Grays, Essex.

For the Southend District: The District Manager, Eastern Electricity Board, 85, London Road, Southend-on-Sea, Essex.

Fens Sub-Area

CAMBRIDGE DISTRICT: DISTRICT ENGINEER (8/51). Applicants should have had a good general and technical education and extensive experience in the planning, construction, operation and maintenance of underground and overhead electricity supply systems, control of staff, and administration. Corporate Membership of the Institution of Electrical Engineers will be an advantage.

The salary will be in accordance with the National Joint Board Agreement, Grade 3, Class E, £775 to £809 per annum.

Applications in writing, stating age, qualifications, experience and details of present employment and salary, should be addressed to the District Manager (Cambridge), Eastern Electricity Board, 4, Market Hill, Cambridge.

Norfolk Sub-Area

KING'S LYNN AND WESTERN DISTRICT: DEMONSTRATOR (10/51). Applicants should have had domestic science training, including electrical housecraft, and should preferably hold the E.A.W. certificate. They should be competent to plan and give cookery demonstrations, including lectures and advice to consumers on the utilisation of domestic electrical appliances. Previous experience in an electricity service centre is desirable.

The salary will be in accordance with Grade 1 (£310 by £20 to £390) of the National Joint Council Salary Agreement, dated 23rd March, 1950.

Applications in writing, stating age, qualifications, experience and details of present employment and salary, should be addressed to The Manager, King's Lynn and Western District, Eastern Electricity Board, Gaywood Bridge, Wooton Road, Gaywood, King's Lynn.

Both future salaries and conditions of service for these appointments will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidate will be required to contribute to a superannuation scheme, and may be required to undergo a medical examination.

Applications should be addressed to the person concerned so as to arrive within 14 days of the appearance of this advertisement, except in the case of No. 39/51R.

6th April, 1951. 1148

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following positions on the staff of the Transmission Engineer at Divisional Headquarters, Portsmouth.

(a) SENIOR ASSISTANT ENGINEER (Construction). Applicants should have considerable experience in the design, layout and erection of high voltage transmission lines, sub-stations and their equipment. Ability to deal with contract correspondence is essential.

(b) THIRD ASSISTANT ENGINEER (Cables). Experience in the design, manufacture, installation, testing and maintenance of high voltage cables up to a voltage of 132 kV is essential.

(c) THIRD ASSISTANT ENGINEER (Overhead Lines). Candidates should have experience in the design and construction of overhead lines up to a voltage of 132 kV with practical knowledge and experience of making line surveys, plotting profiles, checking tower foundations and supervision of overhead line contractors.

(d) THIRD ASSISTANT ENGINEER (Civil and Electrical Clerk of Works). Candidates should have experience of electrical and civil constructional work in high voltage sub-stations up to a voltage of 132 kV.

(e) GENERAL ASSISTANT ENGINEERS: (i) Construction, Overhead Lines; (ii) Construction, Switchgear and Transformers; (iii) Construction, Electrical and Civil Work. Preference will be given to candidates with a knowledge of the construction, maintenance and operation of a high voltage system and a works training on high voltage switchgear and transformers. Experience gained with a contractor on high voltage overhead lines, preferably 132 kV, will be an advantage.

Applicants for appointment (a) should be corporate members of one of the senior professional engineering Institutions.

For other appointments the candidates should be corporate members of a professional engineering Institution or hold qualifications leading to corporate membership.

Salary and conditions of service in accordance with N.J.B. Agreement.

Salary appointment: (a) Schedule C, AX/1 (£884 to £1,045); (b), (c) & (d) Schedule C, AX/5 (£579 to £731); (e) Schedule C, AX/8 (£437 to £586).

The positions are superannuable in accordance with the Authority's scheme and a medical examination may be required.

Forms of application can be obtained from the undersigned and should be returned to the address given below not later than Friday, 27th April, 1951.

P. D. A. OLIVER,
British Electricity House, Divisional Secretary.
111, High Street, Portsmouth. 1169

AIR MINISTRY

Designer/Draughtsmen

APPLICATIONS are invited for the positions of DESIGNER/DRAUGHTSMEN in the Designs Branch of the Works Department in mechanical and electrical engineering. Vacancies are mainly in London but there are some in the provinces. If desired, consideration would be given to making appointments for London only. Salaries are on ranges up to £625 with starting pay in accordance with age and qualifications. Applications, stating age, qualifications, previous appointments (with dates), should be sent to—Air Ministry (S.2.H.), Cornwall House, London, S.E.1, from which address further details may also be obtained. 491

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the Chief Engineer's Department at Area Board Headquarters:—

(1) SENIOR ASSISTANT ENGINEER (Planning Section).

(2) SECOND ASSISTANT ENGINEER (Technical Section).

The salaries will be in accordance with the National Joint Board Agreement, and initially within the following ranges:—

Post (1): £884-£1,015 per annum, AX. 1
Post (2): £752 - £884 per annum, AX. 2

and subsequently according to the classification of the area, which is approaching Class DX.

Applicants for post (1) should be Chartered Electrical Engineers with good technical qualifications. They should have experience of the design, construction and operation of distribution systems and a good knowledge of the technical and economic factors involved in system design. Experience in system layout and design at all voltages up to 33 kV, and in the preparation of complete distribution schemes and estimates is desirable. The successful candidate will be required to undertake work on his own responsibility.

Applicants for post (2) should have the technical qualifications to enable them to become Chartered Electrical Engineers, and have experience in the following branches of Distribution Engineering: fault calculations and investigations, protective gear application and testing, metering, remote control and telecommunications.

The appointments will be superannuable and subject to medical examination.

Application forms, obtainable from the Establishments Officer, Merseyside and North Wales Electricity Board, Electricity House, Love Lane, Pall Mall, Liverpool, 3, should be completed and returned so as to be received not later than 26th April, 1951.

JAMES RANKIN, Secretary.
1133

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the appointment of GENERAL ASSISTANT ENGINEER in the Construction Department at Divisional Headquarters, Woolton, Liverpool.

Commencing salary will be £437/£515 per annum according to age, qualifications and experience, being Class AX, Grade 8, of the N.J.B. Agreement, rising to a maximum of £604 per annum.

Applicants should have a good general and technical education, and possession of a degree in engineering or equivalent qualification would be an advantage. Practical experience in power station construction or operation, or alternatively in a heavy plant manufacturer's works, would be an asset.

The appointment will be superannuable under the terms and conditions of the British Electricity Authority and Area Boards Superannuation Scheme, and may be subject to a medical examination.

Forms of application may be obtained from the Divisional Secretary, Clarke Gardens, Woolton, Liverpool, and should be returned to him not later than Wednesday, 25th April, 1951. 1104

BRITISH ELECTRICITY AUTHORITY

South East Scotland Division

General Assistant Engineer

APPLICATIONS are invited for the appointment of GENERAL ASSISTANT ENGINEER, Class AX/BX (8), in the department of the Transmission Engineer at Portobello, commencing salary £437 per annum.

Salary and conditions of service will be in accordance with the N.J.B. Agreement, and the appointment will be superannuable under the terms and conditions of the Authority's Superannuation Scheme.

Applicants should possess a Higher National Certificate in Electrical Engineering or its equivalent, and preferably should have had some works training.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Controller, British Electricity Authority, South East Scotland Division, British Electricity House, High Street, Portobello, Midlothian, not later than 14 days from the publication of this advertisement.

J. F. FIELD,
Divisional Controller. 1075

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the No. 4/5 Sub-Area (North Wales) of the Board:—

(1) SECTION ENGINEER (Operation), based on Rhyl. Salary in accordance with N.J.B. Class D, Grade 7 (£563/£573 per annum).

(2) COMMERCIAL ASSISTANT (Male), based on (a) Llandudno; (b) Pwllheli. Salary in accordance with N.J.B. Class D, Grade 8 (£524/£542 per annum).

Applicants for post (1) should have experience in all branches of work associated with distribution, including design, construction and operation of E.H.T., H.T. and L.T. overhead and underground systems, and indoor and outdoor sub-station equipment. The district is comprised of both rural and urban areas.

The duties of posts 2(a) and 2(b) will include responsibility to a District Commercial Officer for the sale of appliances and general organisation of the Service Centre, dealing with applications for supply (rural and urban), the preparation of estimates for installation work including the supervision of contracting staff, and where necessary enquiries on changeover schemes. The ability to speak Welsh would be an added qualification, especially for post 2(b). The appointment in Llandudno carries with it the service tenancy of a self-contained flat above the Service Centre.

The appointments are superannuable and subject to medical examination.

Applications, on forms to be obtained from the Manager, No. 4/5 Sub-Area, Merseyside and North Wales Electricity Board, Electricity House, Rhostyllen, Wrexham, should be completed and returned not later than 23rd April, 1951.

JAMES RANKIN, Secretary.
1134

BRITISH ELECTRICITY AUTHORITY

South Western Division

Statistical Engineer, Portishead "A" Power Station

APPLICATIONS are invited for the position of STATISTICAL ENGINEER at Portishead "A" Power Station.

Candidates should have had a good technical education and training and possess as a minimum qualification the Ordinary National Certificate or its equivalent. Experience in a large power station will be considered an advantage.

Salary and conditions of service will be in accordance with the National Joint Board Agreement, Class J, Grade 12, £528-£550 per annum.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, stating age, qualifications, experience, present appointment and salary, should be addressed to the Divisional Secretary, British Electricity Authority, South Western Division, 26, Oakfield Road, Clifton, Bristol, 8, so as to be received not later than 21st April, 1951.

R. C. BARRETT,
2nd April, 1951. Divisional Secretary. 1059

MIDLANDS ELECTRICITY BOARD

South Staffs. and North Worcs. Sub-Area

2nd Assistant Engineer (Construction)

APPLICATIONS are invited for the position of SECOND ASSISTANT ENGINEER (Construction) at Sub-Area Headquarters, Toll End Road, Tipton, Staffs.

Applicants should have had considerable experience in the construction of sub-stations, overhead lines and underground cables at voltages up to and including 33 kV, both by direct labour and by contract. Preference will be given to candidates with appropriate technical qualifications.

Conditions of service will be in accordance with the National Joint Board Agreement for the Electricity Supply Industry and the salary will be in accordance with Class L, Grade 7, £841 per annum.

The successful applicant will be required to contribute to the B.E.A. and Area Boards Superannuation Scheme, if eligible.

Applications, stating age, education, qualifications, experience, present position and salary, should be forwarded within fourteen days to the Sub-Area Manager (Ref. C.W.), Midlands Electricity Board, Toll End Road, Tipton, Staffs. 1085

SOUTHERN ELECTRICITY BOARD

APPLICATIONS are invited for the following posts:

CONSTRUCTION ENGINEER, Uxbridge District of No. 1 (Southall) Sub-Area. Salary N.J.B. Class E, Grade 7 (£579–£591–£606 per annum plus 5% London weighting), N.J.B. Conditions of Service.

Duties will include taking charge, under the District Engineer, of the installation and erection of plant, equipment, laying of mains, indoor and outdoor substations and other constructional work, by direct labour and/or by contract, on an urban distribution system up to and including 11 kV.

Applicants should be at least Graduate Members of the I.E.E., or possess equivalent qualifications, with several years' experience in construction work as defined above. The successful candidate will be required to contribute to the B.E.A. and Area Boards Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him not later than ten days after the appearance of this notice.

ELECTRICAL FITTER, Basingstoke District of No. 3 (Portsmouth) Sub-Area. Rate of pay (3s. 0¼d. per hour) and conditions of service in accordance with N.J.I.C. Agreement for the Electricity Supply Industry.

Candidates must have a first-class knowledge of electrical fittings and have served an apprenticeship in the trade. Experience in substation switchgear and on load tap changing equipment would be an advantage.

Applications, in writing, stating age and qualifications, are to be forwarded to the District Manager, The Manor House, Winchester Road, Basingstoke, not later than ten days after the appearance of this notice.

F. W. KEMPTON, Secretary.
1147

MANCHESTER CORPORATION WATERWORKS

Haweswater Aqueduct

Appointment of Electrical Engineering Assistant

APPLICATIONS are invited for the appointment of ELECTRICAL ENGINEERING ASSISTANT at a commencing salary in the range of £420/£525 p.a. according to qualifications and experience.

The appointment will be to the temporary staff of the Corporation engaged on the development of the Haweswater Scheme. The duties will include assistance in the preparation of specifications in connection with the electrical installations in the various wells and valve houses on the Haweswater Aqueduct, the subsequent supervision of cable laying, jointing, etc. and the inspection of work carried out by contract.

The successful applicant will be required to pass a medical examination, to contribute to the Manchester Corporation Superannuation Fund, and to conform to the Standing Orders of the Council.

Applications stating (1) age, (2) education and training, (3) professional qualifications, and (4) experience, must be accompanied by copies of two recent testimonials and addressed to the Engineer and Manager, Waterworks Offices, Town Hall, Manchester, 2, so as to be received not later than 10 a.m. on Monday, 30th April, 1951.

Canvassing in any form is prohibited, and relationship to any member of the Council or Senior Officer must be disclosed in writing to me.

PHILIP B. DINGLE,
Town Clerk.

Town Hall, Manchester, 2.
April, 1951.
1131

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following position in the Bristol Sub-Area:—

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER, Weston District (Headquarters, Weston-super-Mare). Commencing salary £627 p.a. (Class E, Grade 6, N.J.B. Schedule).

Candidates should have a sound theoretical and practical knowledge of installation and contracting work, I.E.E. and Factory Regulations, and be capable of advising consumers on tariffs and costs.

Experience in rural development work and the possession of appropriate technical qualifications will be an advantage.

Detailed applications, stating present position and salary, age, qualifications and experience, to be submitted to the District Manager (Weston), South Western Electricity Board, 19/20, Waterloo Street, Weston-super-Mare., Som., within ten days.
1145

NOTTINGHAM & DISTRICT TECHNICAL COLLEGE

Shakespeare Street, Nottingham

Principal: H. Baker, Ph.D., A.M.I.C.E., A.M.I.M.E.

APPLICATIONS are invited for the following full-time posts, duties to commence not later than 1st September, 1951, in each case.

1. ASSISTANT LECTURER (GRADE B) IN RADIO ENGINEERING. Applicants should possess Graduate or equivalent qualifications in Electrical Engineering and have had industrial and/or Services experience.

2. ASSISTANT LECTURER (GRADE B) IN ELECTRICAL ENGINEERING. Applicants should possess Graduate or equivalent qualifications in Electrical Engineering and should have had industrial and/or Services technical experience. The successful candidate will be expected to teach Electro-technology and Mathematics to Ordinary National Certificate and Final City and Guilds standard.

Subject to confirmation by the Minister of Education, the salary scale will be £450 × £25 — £725 p.a. A further £60 in respect of a graduate or approved equivalent qualification is payable, plus up to three increments of £18 each for approved periods of training. Regard may be paid to approved industrial experience when assessing the commencing salary.

Forms of application (please specify which post), together with further particulars, may be obtained from the Registrar, Nottingham and District Technical College, Shakespeare St., Nottingham, to whom completed forms should be received not later than 23rd April, 1951.

F. STEPHENSON,
Clerk to Joint Education Committee.
1058

BRITISH ELECTRICITY AUTHORITY

3rd Assistant Engineer (Overhead Lines), Chief Engineer's Department, London

APPLICATIONS are invited for the appointment of 3RD ASSISTANT ENGINEER (Overhead Lines) in the Transmission Design Branch at Headquarters in London.

Candidates should have educational qualifications not less than those required for Associate Membership of the Inst.C.E. or the I.E.E. They should have experience in the design, construction and maintenance of high voltage steel tower overhead lines. Familiarity with calculations in the detailed design of the steel towers themselves and the design of foundations in varying classes of ground, would be an advantage.

The duties will be to study new developments, to analyse and follow up the results of service experience and to advise on the application of new equipment and new methods to the Authority's high voltage transmission systems.

The starting salary for the appointment, which is superannuable, will be in accordance with age and experience, within Grade 4 of the N.J.B. Agreement, £676–£807 p.a. rising to £891 p.a., including London allowance.

Applications, stating age, present salary and giving full details of qualifications and experience, should be forwarded to D. Moffat, Director of Establishments, British Electricity Authority, British Electricity House, Great Portland Street, London, W.1, so as to be received not later than 27th April, 1951.

Please quote Reference AE/151.
1142

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the position of ASSISTANT SHIFT CHARGE ENGINEER at Walsall Generating Station, Class G, Grade 9, commencing salary £571 per annum.

Applicants should possess the National Certificate in mechanical engineering or an equivalent qualification and should have had sound technical training. Experience in power station operation will be considered an advantage.

Salary and conditions of service will be in accordance with the N.J.B. Agreement, and superannuation under terms approved by the British Electricity Authority.

Applications should be made on forms which may be obtained from the Divisional Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, and be returned not later than 28th April, 1951.

F. W. LAWTON, Divisional Controller.
1143

BRITISH ELECTRICITY AUTHORITY

Senior Assistant Engineers, Generation Construction Sub-Department, Headquarters

APPLICATIONS are invited for two appointments as SENIOR ASSISTANT ENGINEERS in the Co-ordination Branch of the Generation Construction Sub-Department at Headquarters in London.

Candidates must hold the requisite qualifications for Associate Membership of either the I.Mech.E. or the I.E.E. Practical experience in the construction of modern power stations, including handling of contracts, preparation of commissioning programmes, practical experience of work on site and general co-ordination of the work from inception of the project to ultimate commissioning are essential, and only those possessing such experience need apply.

Those appointed will require to be responsible for co-ordinating generation construction work at a group of power stations. They will be based at headquarters but their duties will entail attendance at site meetings and visits to power stations in various parts of the country.

Starting salaries for the appointments, which are superannuable, will be determined according to qualifications and experience within Grade 1 of the N.J.B. Agreement, £492 p.a. to £1,169 p.a., rising to a maximum of £1,285 p.a., all inclusive of London allowance.

Applications stating age, present salary and giving full details of qualifications and experience should be forwarded to D. Moffat, Director of Establishments, British Electricity Authority, British Electricity House, Great Portland Street, London, W.1, so as to be received not later than 28th April, 1951. Please quote Reference AE/153. 1140

ADMIRALTY

VACANCIES exist for ELECTRICAL and/or MECHANICAL ENGINEERING DRAUGHTSMEN in Admiralty Research and Development Establishments located in the vicinity of Weymouth, Portsmouth, Teddington (Middlesex) and Baldock (Herts).

Draughtsmen experienced in light current, electro-mechanical, precision mechanical and electronic equipment are particularly needed.

Candidates must be British subjects of 21 years of age and upwards, who have had practical workshop experience (preferably an apprenticeship) together with drawing office experience.

Appointments will be in an unestablished capacity, but opportunities may occur for qualified staff to compete for established posts.

The salaries offered, depending on age, experience, ability and place of duty, will be within the range £283-£510 p.a.

Exceptionally well qualified candidates may be considered for appointment in a higher grade within the salary range £470-£610 p.a.

Hostel accommodation is available at some establishments.

Applications, stating age and details of technical qualifications and apprenticeship (or equivalents) and workshop and drawing office experience, should be sent to Admiralty (C.E.II, Room 88), Empire Hotel, Bath. Original testimonials should not be forwarded with application. Candidates required for interview (at London or Bath whichever is nearest) will be advised within two weeks of application. 222

BRITISH ELECTRICITY AUTHORITY

South Western Division

Power Station Superintendent, Exeter Power Station

APPLICATIONS are invited for the appointment of POWER STATION SUPERINTENDENT at Exeter Power Station, South Western Division.

Candidates should be qualified engineers with practical experience in the operation and maintenance of a steam power station. They should also have had experience in the administrative duties involved and in the control of technical and manual employees.

Conditions of service and salary will be in accordance with the National Joint Board Agreement, Class D, Grade 1, £883 to £997 per annum.

Applications stating age, qualifications, full details of experience, present appointment and salary, should be addressed to the Divisional Secretary, British Electricity Authority, South Western Division, British Electricity House, 26, Oakfield Road, Clifton, Bristol, 8, so as to be received not later than the 21st April, 1951.

R. C. BARRETT,
6th April, 1951. Divisional Secretary.
1135

BRITISH ELECTRICITY AUTHORITY

South Wales Division

APPLICATIONS are invited for the following appointments:—

(a) ASSISTANT SHIFT CHARGE ENGINEER, Tir John Power Station at a salary in accordance with the Revised National Joint Board Agreement, Class G, Grade 9 (£571-£597 per annum).

(b) DRAUGHTSMAN in the Transmission Department, Divisional Headquarters at a salary within the range (£375-£536 per annum). This salary is provisional pending negotiation through the National Joint Board.

Applicants for both appointments should preferably have obtained the Higher National Certificate and those for (a) should have served a recognised apprenticeship.

Experience in the operating of a modern Power Station using pulverised fuel boilers is essential for appointment (a) whereas knowledge and experience of Sub-station plant and layout would be considered an advantage for appointment (b).

The appointment is superannuable in accordance with the British Electricity Authority, and Area Boards Scheme.

Forms of application may be obtained from the Divisional Secretary's Office at the address below to whom completed applications should be returned not later than 28th April, 1951.

H. V. PUGH,
Cardiff (Pengam Moors) Aiport, Cardiff. Divisional Controller.
1168

CROWN AGENTS FOR THE COLONIES

ELECTRICAL ENGINEER (Hydro-Electric) required by the Central Electricity Board, Federation of Malaya, for 3 years with prospect of permanency. Salary (including expatriation pay) payable in local currency, equivalent at the present Government rate of exchange to £742 a year rising to £1,652 a year. Commencing salary according to age and experience. Cost of living allowance equivalent to between £210 and £525 a year, according to salary and dependents. Free passages. Liberal leave on full salary.

Candidates, between 24 and 35 years of age, must be Corporate Members or Graduates of the Institution of Electrical Engineers (or the equivalent), and have had sound training in both electrical and mechanical engineering with experience in the operation of medium electricity supply undertakings. They should possess a competent knowledge of the erection and maintenance of high and low tension overhead and underground A.C. distribution systems and substation plant. Experience in maintenance and operation of diesel engines a distinct advantage. Preference will be given to candidates with experience of hydro-electrical construction.

Apply at once by letter, stating age, full names in block letters and full particulars of qualifications and experience and mentioning this paper to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M.25728/B. on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. 1146

BRITISH ELECTRICITY AUTHORITY

Yorkshire Division

Maintenance Engineer (Mechanical)

APPLICATIONS are invited for the position of MAINTENANCE ENGINEER (Mechanical) at Blackburn Meadows Power Station, Sheffield.

Conditions of service and salary will be in accordance with the National Joint Board Agreement, Class H, Grade 7, £692-£722 per annum.

Applicants must have a good technical training and have administrative ability, with a wide experience in power station mechanical maintenance, and in particular the planning and progressing of turbine and auxiliary overhauls. Experience in a manufacturer's works will be an advantage.

The appointment will be subject to the provisions of the Authority's Superannuation Scheme.

Forms of application may be obtained from the Divisional Secretary, British Electricity Authority, Yorkshire Division, British Electricity House, St. Mary's Road, Leeds, 7, to whom completed forms should be returned within 14 days of the appearance of this advertisement. Envelopes to be endorsed "Maintenance Engineer (Mechanical), Blackburn Meadows Power Station."

G. A. VOWLES,
Divisional Controller. 1084

SUDAN GOVERNMENT

Ministry of Education

THE Director of Education invites applications for the post of INSPECTOR OF TRADE SCHOOLS in the Southern Sudan, aged not less than 30 on the 1st July, 1951.

Candidates must have had industrial experience in mechanical engineering or in the building industry and be members of an appropriate professional body. Preference will be given to candidates with these qualifications coupled with administrative experience in a Government training centre or in a trade training section of a technical college either in the United Kingdom or abroad.

Appointment will be on probation for either a Long Term Contract (salary range £E.617-£E.1,316) with special post-service gratuity, or a Provident Fund Contract (salary range £E.720-£E.1,547), or a Short Term Contract (salary range £E.771-£E.1,644), with different post-service benefits.

Cost-of-living allowance varying between £E.142 and £E.352 p.a. according to the number of dependants is at present payable, and, subject to certain limitations, an outfit allowance of £E.60 is payable on appointment. Free passage on appointment. There is at present no income tax in the Sudan.

Further particulars and application forms are available on written application from the Sudan Agent in London, Sudan Agency, Wellington House, Buckingham Gate, London, S.W.1. Please mark envelope " Inspector, South 4/304." 1082

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the appointment of GENERAL ASSISTANT ENGINEER (Instructor) at the Divisional Training Centre at Queensferry, Flint.

The duties will include the supervision and instruction of craft and student apprentices and graduate trainees in basic workshop practice, the necessary demonstrating, lecturing and general clerical work in connection with the centre.

Candidates must have served a recognised workshop apprenticeship and have had experience of instructing in the use of hand and machine tools, methods of heat treatment, elementary electrical practice, etc.

The salary will be in accordance with the National Joint Board, Schedule C, Class AX, Grade 8, i.e., £437/£569, according to qualifications and experience, rising to a maximum of £604.

The appointment will be superannuable under the terms and conditions of the British Electricity Authority and Area Boards Superannuation Scheme, and may be subject to a medical examination.

Forms of application may be obtained from the Divisional Secretary, Clarke Gardens, Woolton, Liverpool, and should be returned to him not later than Friday, 27th April, 1951.

A. R. COOPER,
Divisional Controller. 1105

BRITISH ELECTRICITY AUTHORITY

North Western Division

APPLICATIONS are invited for the post of SHIFT CHARGE ENGINEER at the Greenhill Generating Station, Oldham.

The salary range for this position, which is superannuable, will be £579/£609 per annum, in accordance with Grade 7, Class E, of the National Joint Board Agreement.

Candidates should preferably possess technical qualifications, and previous experience in a generating station is essential.

Applications, stating age, qualifications, present position and giving full details of education and experience, should be received by the Establishment Officer, British Electricity House, Wilmslow Road, East Didsbury, Manchester, 20, not later than 21st April, 1951. 1083

BRITISH ELECTRICITY AUTHORITY

ASSISTANT MAINTENANCE ENGINEER (Electrical), Croydon " B " Power Station. Higher National Certificate preferable. Experience in maintenance of alternators, E.H.T. and L.T. switchgear, motors and all power station electrical and auxiliary plant essential. N.J.B. conditions of service and salary, Class J, Grade 9, commencing at £678 6s. 8d. p.a., including London allowance.

Applications, on forms obtainable from the Divisional Secretary, B.E.A., S.E. Division, Lower Ham Road, Kingston-on-Thames, to be returned by 21st April, 1951. 1102

ADMIRALTY

TEMPORARY ASSISTANT OVERSEERS experienced in all electrical engineering techniques are required for temporary service in the Overseeing service of the Electrical Engineering Dept., Admiralty. Vacancies exist at Glasgow, Belfast, Manchester, Newcastle, Nottingham, Gainsborough and Edinburgh, and further vacancies are expected to arise in other towns. Candidates must be British subjects of 21 years of age and upwards who have had practical workshop experience and preferably an apprenticeship.

Salary will be assessed according to age, qualifications and experience on a range with a London maximum of £625 p.a. For candidates of 30 years of age salary will normally be related directly to age, i.e., £500 p.a. (London), and for younger candidates will be approximately £20 p.a. less than the age 30 rate for each year of age they are under 30.

The London rates are reduced by from £10 to £15 p.a. at intermediate centres such as Belfast, Glasgow, Manchester and Newcastle, and by from £20 to £30 p.a. at other towns in the provinces.

Applications, stating age, details of technical qualifications and of apprenticeship (or equivalent) and workshop experience, should be sent to the Admiralty, Empire Hotel (C.E.H. Room 83), Bath. Candidates will be interviewed locally as soon as possible after receipt of their applications. 1100

NORTH EASTERN ELECTRICITY BOARD

Principal Assistant, Accountant's Dept., Wear Sub-Area

APPLICATIONS are invited for the position of PRINCIPAL ASSISTANT in the Wear Sub-Area, Accountant's Department, with Headquarters at Sunderland.

The appointment will be within Grade 7 of the National Joint Council Salary Agreement, viz., £705 × £30 to £795 per annum, commencing salary according to experience and qualifications.

The selected applicant will be required to enter the British Electricity Authority and Area Boards Superannuation Scheme.

The successful candidate will be responsible to the Sub-Area Accountant for the supervision of staff in the department. It is essential he should have a sound practical knowledge of accountancy, including consumer accounts and costs and stores accountancy, preferably in a public utility undertaking. Knowledge and experience of a punched card accountancy system will be an advantage.

Applications in writing, stating age, qualifications and experience, together with the names and addresses of two persons to whom reference may be made, should be forwarded to the Secretary, Establishments Section, North Eastern Electricity Board, Carlicl House, Newcastle-on-Tyne, 1, within fourteen days of publication of this advertisement. 1101

ELECTRICAL/MECHANICAL INSPECTOR FOR MIDDLE EAST

AN ELECTRICAL/MECHANICAL INSPECTOR is required by a major British Oil Company for service in the Middle East. Applicants must have wide experience covering maintenance and inspection of installed plant associated with modern large generating stations with voltage range of 33 kV to 440 volts. Knowledge of flameproof switchgear an advantage. Possession of H.N.C. essential and qualifications up to A.M.I.E.E. desirable Age limit 37 years. Attractive salary plus generous allowance in local currency designed to assist substantially in meeting cost-of-living, free passages, kit allowance, free medical attention, good leave arrangement, pension scheme. Write, giving personal particulars and details of qualifications and experience, quoting Dept. F.7, to Box 3292, at 191, Gresham House, E.C.2 1088

LONDON ELECTRICITY BOARD

Demonstrator (Female)

APPLICATIONS are invited for the above position at Barking. Possession of E.A.W. or similar certificate essential. Experience in conducting demonstrations and a knowledge of domestic electrical appliances an advantage.

Salary in accordance with the National Joint Council (Administrative and Clerical Grades) Agreement, Grade 1, £325 to £420 per annum inclusive, commencing salary being fixed according to qualifications and experience.

Application forms, obtainable from the Establishments Officer, 46, New Broad Street, London, E.C.2, to be returned within 7 days. Please enclose addressed foolscap envelope and quote ref. EST/V/1191/R on envelope and all correspondence. 1107

BRITISH ELECTRICITY AUTHORITY

North Eastern Division

Third Assistant Engineer, Technical Department (Calculations and System Planning)

APPLICATIONS are invited for the above-mentioned appointment at Divisional Headquarters, Newcastle-upon-Tyne. Candidates should have technical qualification of at least Graduate I.E.E. standard and experience connected with a large inter-connected power system. A University Degree would be an advantage.

The engineer appointed will be required to carry out system fault and load flow calculations, and assist in planning and the preparation of reports. Experience in similar work is very desirable.

The salary will be in accordance with the National Joint Board Agreement, Grade 5, Schedule C (£579-£753 per annum), and will commence at a point commensurate with qualifications and experience.

Superannuation will be in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Forms of application may be obtained from the Divisional Secretary (Establishments), British Electricity Authority, North Eastern Division, Carliol House, Newcastle-upon-Tyne, 1, to whom they should be returned to arrive not later than 28th April, 1951. 1136

City of Birmingham Education Committee

ASTON TECHNICAL COLLEGE

Whitehead Road, Birmingham, 6

Principal: D. Dudgeon Stockley, B.Sc., M.I.Mech.E., F.I.I.A.

APPLICATIONS are invited for the post of FULL-TIME ASSISTANT, Grade A, in the Department of Electrical Engineering and Engineering Mathematics, to commence duties on 1st September, 1951. Candidates should have a degree or equivalent and industrial or teaching experience; they should be prepared to teach Engineering Mathematics and/or Electrical Engineering. Salary according to new Burnham (Further Education) Scale for Assistants (A), £375 by £18 to £630 (men), with additions for graduate qualification, £60 (men), and training where applicable. In fixing the commencing salary increments will be allowed for teaching and approved industrial experience.

Further particulars and application form may be obtained by sending stamped addressed envelope to the Principal, to whom applications should be returned within 14 days of appearance of this advertisement.

E. L. RUSSELL,
Chief Education Officer. 1074

BRITISH ELECTRICITY AUTHORITY

South Wales Division

APPLICATIONS are invited for the position of ELECTRICAL FITTER in the Transmission Section of this Division, to be situated at Neath Section Office at the current rate of 3s. 0¼d. per hour.

Wages and conditions of service will be in accordance with the National Joint Industrial Council Agreement.

Applicants should preferably be conversant with maintenance of high-voltage electrical substation equipment. Possession of a current driving licence would be considered an advantage.

Applications should be made in writing to the Section Engineer, British Electricity Authority, South Wales Division, Riverside, Neath, Glam., not later than 18th April, 1951.

H. V. PUGH,
Cardiff (Pengam Moors) Divisional Controller.
Airport, Cardiff.
4th April, 1951. 1138

SKILLED ELECTRICIANS

APPLICATIONS are invited for three fully skilled ELECTRICIANS for Shift Maintenance duties at a large new Rolling Mill in the Neath area, South Wales. They should have a wide experience of installation and maintenance of H.T. and L.T., A.C. and D.C. rolling mill plant, including Ward Leonard and Tandem Mill control. Excellent prospects for suitable applicants. Apply to:—

THE SOUTH WALES ALUMINIUM CO. LTD.
Rheola Works, Resolven, Glam. 933

BRITISH ELECTRICITY AUTHORITY

South Western Division

Shift Charge Engineer, Castle Meads Power Station

APPLICATIONS are invited for the position of SHIFT CHARGE ENGINEER at Castle Meads Power Station, Gloucester.

Candidates should have had good technical experience, a sound knowledge of the operation and maintenance of generating plant, and preference will be given to applicants possessing the Higher National Certificate or equivalent qualifications.

Salary and conditions of service will be in accordance with the National Joint Board Agreement, Class E, Grade 7, £579-£609 per annum.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, stating age, qualifications, experience, present appointment and salary, should be addressed to the Divisional Secretary, British Electricity Authority, South Western Division, British Electricity House, 26, Oakfield Road, Clifton, Bristol, 8, so as to be received not later than 21st April, 1951.

R. C. BARRETT,
2nd April, 1951. Divisional Secretary. 1060

BRITISH ELECTRICITY AUTHORITY

General Assistant Engineer, Chief Engineer's Dept., Headquarters

APPLICATIONS are invited for the post of GENERAL ASSISTANT ENGINEER in the Generation Operation Branch at Headquarters in London.

The duties will be to assist in the keeping of records, the production of technical returns and the investigation and analysis of generating station operating results.

The candidate should possess ability in mathematics, should preferably have experience of power station operation, repairs and maintenance, and should be able to report results in good, simple English.

The starting salary will be within Grade 5 of the N.J.B. Agreement, £490-£624 p.a., according to qualifications and experience, rising to a maximum of £689 p.a., including London Allowance.

Applications, stating age, present salary and giving full details of qualifications and experience, should be forwarded to D. Moffat, Director of Establishments, British Electricity Authority, British Electricity House, Great Portland Street, London, W.1, so as to be received not later than 27th April, 1951. Please quote Reference AE/152. 1141

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the following appointments:—

SHIFT CHARGE ENGINEER.

(a) At Percival Lane Power Station, Runcorn. Salary N.J.B. Class G, Grade 7, £651/£679 p.a.

(b) At Warrington Power Station. Salary N.J.B. Class F, Grade 7, £625/£643 p.a.

Applicants must have had experience in the operation of power station plant. Preference will be given to the candidates who are Associate Members of a recognised Institute or who possess equivalent technical qualifications.

The appointments are superannuable under the British Electricity Authority and Area Boards Superannuation Scheme, and may be subject to a medical examination.

Forms of application may be obtained from the Divisional Secretary, Clarke Gardens, Woolton, Liverpool, and should be returned to him not later than Wednesday, 25th April, 1951.

A. R. COOPER,
Divisional Controller. 1163

SWITCHGEAR

JOHNSON & PHILLIPS Ltd. require two SENIOR DRAUGHTSMEN. Applicants must be suitably qualified and competent to handle switchgear for indoor and outdoor main stations and sub-stations up to 33,000 v., or to design switchgear apparatus embracing air break and oil break circuit breakers. Both positions offer good scope to the right man with prospects of early promotion. Applications in writing, stating age, experience and salary required, to—Employment and Welfare Manager, Johnson & Phillips Ltd., Charlton, London, S.E.7. 932

MIDLANDS ELECTRICITY BOARD

South Staffs. and North Worcs. Sub-Area

Appointment of General Assistant Engineer, Dudley District

APPLICATIONS are invited for the above appointment in the Dudley District of the South Staffs. and North Worcs. Sub-Area.

Applicants should have had experience in all branches of distribution work, including operation and maintenance of high-voltage and low-voltage underground cables, substations, etc. Appropriate technical qualifications will be considered an advantage.

The conditions of service will be in accordance with the N.J.B. Agreement, and the salary, subject to negotiation, will be Class E, Grade 11, £459.

Applications in writing, stating age, qualifications, experience and present salary, should be forwarded within seven days to Mr. T. G. Keeler (Ref. C.W.), Sub-Area Manager, Midlands Electricity Board, South Staffs. and North Worcs. Sub-Area, Toll End Road, Tipton, Staffs. 1086

RESIDENT CONSTRUCTION ENGINEER

REQUIRED, a RESIDENT CONSTRUCTION ENGINEER by the Consulting Engineers to the Malta Government to supervise, on their behalf, the erection, installation and testing in Malta of a complete steam power plant comprising 3 × 5,000-kW sets and 3 × 70,000-lb. oil-fired boilers and associated equipment. The successful applicant would also be responsible for supervising the laying of a new three-phase distribution system and the remodelling of sections of the existing single-phase system for three-phase working (11 kV and 400 volts).

Applicants should be between 30 and 45 years old. Graduate Members of one of the senior Institutions or have similar qualification, and have had previous constructional, operation and administrative experience in the electricity supply or allied industry.

The appointment is temporary for approximately two years, which may be extended by agreement. Salary between £1,250 and £1,500 p.a. according to qualifications. Free first-class passage out and home and local travelling expenses at Malta Government rates.

Apply with full details of previous experience to Preece, Cardew & Rider, 8 & 10, Queen Anne's Gate, Westminster, London, S.W.1. 1087

MIDLANDS ELECTRICITY BOARD

North Staffordshire Sub-Area

Appointment of District Engineer, Market Drayton

APPLICATIONS are invited for the above position in the North Staffs Sub-Area. Applicants must have had considerable experience in all branches of distribution work, including the operation and maintenance of high and low voltage cables, overhead lines, substations, protective gear, etc. Candidates with appropriate technical qualifications will be preferred.

The appointment will be in accordance with the National Joint Board conditions and the salary will be Class B, Grade 3, £653 per annum.

Applications, stating age, qualifications, experience, present position and salary, should be forwarded within 14 days to Mr. H. A. P. Caddell, Manager, North Staffordshire Sub-Area, 31, Kingsway, Stoke-on-Trent.

A. STEPHENS,
Secretary.

3rd April, 1951. 1137

SWITCHGEAR DRAUGHTSMEN FOR JOHANNESBURG

APPLICANTS must have good practical and technical experience, particularly in diagram and schematic work. Single men preferred, age 22 to 25. Applications in writing, stating details of training, experience, age and salary expected, to—Employment and Welfare Manager, Johnson & Phillips Ltd., Victoria Works, Charlton, S.E.7. 1008

LONDON COUNTY COUNCIL

REQUIRED at Hackney Technical College, Dalston Lane, E.8, to commence in September, 1951, visiting LECTURER to take 3rd year Electrical Installation Course B, for City and Guilds in Calculations and Drawing. Class meets on Wednesdays from 7 p.m. to 9 p.m.

Pay is 22s. 6d. per evening. Applications to the Principal, (402) 1076

YORKSHIRE ELECTRICITY BOARD

No. 5 (Wakefield) Sub-Area

APPLICATIONS are invited for the following appointment:—

THIRD ASSISTANT DISTRICT ENGINEER (Barnsley) (Vacancy No. 62/50). Applicants must have had experience in a large undertaking employing E.H.V. and L.V. underground mains. Experience in fault location, supervision of jointing, cable laying, and the erection of overhead lines would be an advantage. Preference will be given to Corporate Members of the Institution of Electrical Engineers.

Salary, N.J.B. Schedule, Class F, Grade 9, £538/£568 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, within fourteen days of the appearance of this advertisement. 1132

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

Assistant Shift Charge Engineer, Burton-on-Trent

APPLICATIONS are invited for the position of ASSISTANT SHIFT CHARGE ENGINEER at Burton-on-Trent Generating Station.

Applicants should have sound technical qualifications and experience in the operation and maintenance of modern power stations.

The salary will be in accordance with Class E, Grade 9, and the appointment will be superannuable under the provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, not later than 23rd April, 1951.

W. S. BURGE, Divisional Controller. 1033

SOUTH EAST SCOTLAND ELECTRICITY BOARD

Southern Sub-Area

APPLICATIONS are invited for the post of ASSISTANT ENGINEER (Hawick District). Salary and conditions of service will be in accordance with the N.J.B. Schedule, Class B, Grade 7 (£492-£505-£518).

Applicants should have experience in the construction, operation and maintenance of H.V. and L.V. rural and urban distribution systems and must have had a sound practical training. Preference will be given to those holding the Higher National Certificate or equivalent.

The appointment will be superannuable under the B.E.A. and Area Boards Superannuation Scheme.

Applications, stating age and particulars of education, training, experience and positions held, should reach the undersigned not later than 14 days after the appearance of this advertisement.

G. H. SANKEY,
Sub-Area Manager.

High Street,
Galashiels. 1099

SOUTH EASTERN ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER, Mid-Sussex Sub-Area Headquarters. Salary £571 p.a. rising to £597 p.a. under the N.J.B. Schedule, Cass H, Grade 10. Superannuation will be arranged.

Minimum technical qualification, Higher and Ordinary National Certificates in Electrical Engineering. Applicants must have had training in distribution engineering and experience in planning, construction, operation and maintenance of urban and rural systems up to and including 33 kV. Particular knowledge of protective system design, operation and testing will be an advantage.

Applications, giving two referees, must reach H. Pryce-Jones, M.Eng., M.I.C.E., Mid-Sussex Manager, South Eastern Electricity Board, Electric House, Castle Square, Brighton, by 23rd April, 1951.

A. L. BURNELL,
Secretary. 1100

A COMPETENT storekeeper required by large electrical contractors in Manchester. Applicants must have had considerable experience. Must be capable of introducing and organising a complete stores system and his duties will include buying. A good salary will be offered to the right man.—Box 9675.

A YOUNG electrical engineer with an interest in contracts work is required by the Marine Department of the English Electric Company, Rugby. Applicants should be of H.N.C. standard, and have had practical engineering experience. Preference will be given to those with a commercial and/or marine background. Write, giving full details and quoting ref. 430A, to—Central Personnel Services, English Electric Co. Ltd., 24/30, Gillingham Street, London, S.W.1. 1114

A.C. and D.C. house service meter tester and repairer, London, S.W.—Box 137.

ACCOUNTS clerk required by well-known London W.1. contractors. Must have full knowledge of preparation of invoices for all types of installation contracts and able to agree final accounts with quantity surveyors, etc. Permanent post with good prospects for suitable applicant. Details of experience and salary required, in confidence, to—Box 1155.

AN assistant engineer is required for work in connection with the application of semi-conductors (in particular, stage dependent materials) to industry. Applicants must be of Higher National to degree standard. Salary according to age, qualifications and experience. Reply, giving full particulars, including age, education, experience, qualifications, etc., marking envelopes "Research," to—Personnel Manager, Metropolitan-Vickers Electrical Co. Ltd., Trafford Park, Manchester, 17. 1042

AN assistant foreman C.R. tubes; advertising manager also handle exhibitions; physicists; product engineer (instruments and electronics (Scotland); development engineer marine radio; chief draughtsman power house; draughtsmen and tracers; electronic and radar development engineers; testers f.h.p. motors; transformer designers and testers; motion study engineers; electrical engineers, B.Sc.—Technical Employment Agency, 179, Clapham Road, London, S.W.9 (Brixton 3487). 1109

AN electrical engineer experienced in design of transformers or complete rectifiers of small and medium output required by leading British manufacturer. Modern factory with excellent amenities. Good prospects for a well-trained and ambitious man. Attractive salary with annual bonus and contributory pension scheme. Write, giving full details, to—Box 936.

ANGLO-IRANIAN OIL Company requires one electrical engineering draughtsman for work in London with visits abroad. Age 23-30. Ordinary National Certificate in electrical engineering essential. Higher National Certificate desirable. Practical experience to include 5 years' apprenticeship followed by two years in the drawing office of a firm engaged in the design layout of power station plant, H.V. sub-stations, switchgear, distribution networks and electrical installations. Applicants should write, stating age, qualifications and experience, quoting Department M.1297, to—Box 6185, at 191, Gresham House, London, E.C.2. 1091

APPLICATIONS are invited for the following positions in the London area: Development engineers required by manufacturers of A.C. and D.C. electrical equipment for aircraft. Applicants should hold at least a Higher National Certificate or preferably an engineering degree. The positions are superannuated and give considerable scope to men with adequate experience. Write, giving full details in strictest confidence, to—The Employment Officer, Rotax Ltd., Chandos Road, Willesden Junction, London, N.W.10. 850

APPLICATIONS are invited for the following positions in the London area: Draughtsmen required for detail drawing of experimental designs of aircraft electrical equipment. Works experience essential. Write, giving full details in strictest confidence, to—The Employment Officer, Rotax Ltd., Chandos Road, Willesden Junction, London, N.W.10. 851

APPLICATIONS are invited for the position of assistant buyer for J. A. Crabtree & Co. Ltd., manufacturing electrical engineers. Experience in the same or similar industry is an essential qualification. Applications, by letter only, should be addressed to The Secretary at Lincoln Works, Walsall and should state age, details of experience, appointments held and salary required. 1158

ARMATURE winder and improver for repair shop, A.C. and D.C. repairs, S.W.6 area.—Box 845.

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Company Limited, 24, Fennel Street, Manchester, 4. The company has a vacancy for an electrical plant inspector in Lincoln. Permanent position carrying progressive salary scale £450 to £650 and non-contributory pension. Candidates, age 26 to 33 years, with apprenticeship in the manufacture of electrical machinery and preferably with subsequent experience of repairs and industrial use of electrical machinery, and who have gained the Higher National Certificate in electrical engineering or are Grad. I.E.E., are invited to apply in own handwriting, stating age, qualifications and experience. 1093

BELLING & LEE Ltd., Cambridge Arterial Road, Enfield, Middlesex, have a vacancy for a technical sales correspondent (aged 20/23) qualified either to City & Guilds, Radio II and Electrical I, or Ordinary National Certificate with radio endorsement; some knowledge of interference suppression and/or thermally operated switches would be useful. Applications to state age, qualifications, experience and salary required, and to be endorsed "Technical Sales." 1108

BOILER operator required for new water tube boilers. Mechanical stoking and coal handling. Applicants should have knowledge of combustion controls. 44 hours, shift work, full trade rates. Apply in writing, giving details of previous experience, to—Chief Engineer, Guy's Hospital, London, S.E.1. 873

CABLE-makers require foreman for new plastics department. Polythene, P.V.C. and nylon. Most up-to-date machinery. Progressive post.—Box 1063.

CHARTERED patent agents in London require technical assistant, preferably with degree in engineering or physics and knowledge of electronics; some German and/or French an advantage; patent experience not essential; good prospects. Full particulars to—Box 1113.

COMMERCIAL technical assistant required by lamp manufacturers, E.L.M.A. members, for commercial dept. in Central London. Good education and electrical knowledge to Nat. Cert. standard, with experience of lamp commercial work and sales correspondence. Lighting knowledge an advantage. Age 25/30. State full particulars and salary required to—Box 895.

CONSTRUCTION engineer for Saudi Arabia to supervise on behalf of the purchaser the installation of a diesel generating plant of some 3,500 kW and an 11-kV and low-voltage overhead and underground distribution network. Applicants should be under 45 years of age, corporate members of one or more of the senior institutions, and should have previous construction experience of the type indicated. Knowledge of Arabic an advantage. Appointment is for two years initially. Starting salary not less than £130 per month, rising £10 per month in second year, free furnished quarters, and leave at rate of one day for each six days of effective service at end of first engagement. Applications, giving full details of previous experience, to—Preece, Cardew & Rider, 8-10, Queen Anne's Gate, London, S.W.1. 1110

DESIGNER-draughtsman with sound knowledge of small mechanical and electrical appliances, able to work on own initiative. Permanency, pensionable. N.1 district. State age, experience and salary required.—Box 965.

DEVELOPMENT engineer for old-established firm of precision electrical instrument makers in S.E. area. Applicants should have good electrical and mechanical training on precision instruments and knowledge of data transmission equipment, servos and electronics. The position is a responsible one requiring a man with ability to supervise and direct staff. Salary from £750 according to experience. Applications giving full particulars of age, experience and salary required to—Box 1041.

DRAUGHTSMAN (electrical wiring) with experience of small Admiralty vessels and some knowledge of small electrical marine work an advantage, for Hull district. State experience, age and wage required to—Box 839.

DRAUGHTSMAN req'd for designing loudspeakers and microphones. Previous experience desirable though not essential. Please apply in writing to—Vitavox Ltd., Westmoreland Rd., London, N.W.9. 985

DRAUGHTSMAN required (Walthamstow area). Applicants must have served apprenticeship and have had good general experience. Good working conditions. Pension scheme. Reply, stating age, experience and salary required, to—Box 1062.

DRAUGHTSMEN, junior and senior, wanted urgently for layout and design work of automatic motor control gear. Good pay. Canteen facilities. Apply — Electro Dynamic Construction Co. Ltd., Control Gear Division, Bristol Road, Bridgwater. 821

DRAUGHTSMEN wanted by makers of industrial electrical control gear, London area. Full details experience, age and salary to—Box 1066.

ELECTRIC lamps. The following vacancies exist at our Middlesbrough factory engaged on the production of auto and other miniature lamp bulbs. Foreman for stem making, must be fully experienced in setting up and flame setting. Foreman for headlamp production to take charge of sealing and pumping, must be fully experienced. Assistance with housing if required. Write stating age, experience and salary required.—K.X. Lamps Ltd., 62, Brewery Road, Islington, N.7. 1156

ELECTRICAL engineer assistant. University or equivalent engineering degree, and works training, experience in electrical installation and inspection work essential. Write, stating qualifes., experience, age, and salary required to Chief Engineer, United Dairies Ltd., Abbey Works, Cumberland Ave., N.W.10. 1157

ELECTRICAL draughtsman required for paper mill work, preferably one who has had experience in a similar capacity. Applications giving age, details of experience and salary required to—Bowater's Thames Paper Mills Limited, Northfleet, Kent. 9682

ELECTRICAL engineer draughtsman required with experience in the design and installation of power and lighting schemes, distribution and control diagrams, etc. Excellent prospects for suitable man offered by Tees-side firm. Apply giving full particulars, quoting reference F.D. to—Box 1043.

ELECTRICAL engineer for inspection of plant and machinery in works of the Tube Investments Group of companies. Knowledge of statutory requirements and previous experience necessary. Position offers opportunity for gaining wide experience and has good prospects. State age, qualifications, experience and salary required. to—Personnel Manager, T.I. (Group Services) Limited, Rocky Lane, Aston, Birmingham, 6. 1159

ELECTRICAL engineer, preferably qualified and/or with commercial experience, required for responsible position in Pakistan. Minimum salary adequate for local conditions, including social expenses, and will be in accordance with qualifications and experience. Single man aged 25-35 preferred. Applicants must have sound knowledge theory and practice of power transmission and distribution. Selected applicant will receive training in factory before going abroad. Knowledge of line communication system an advantage. The post offers good prospects with an old-established company.—Box 1094.

ELECTRICAL engineers and contractors require experienced estimator for Midland office. Experience with Government contracts an advantage.—Box 991.

ELECTRICIAN wanted for maintenance, installation, etc., of electrical equipment in laundries, London area. Please write, stating age, experience, wages required, to—Box E.R.739, at 191, Gresham House, London E.C.2. 959

ELECTRICIANS with general contractors' experience; local work; permanent position offered to good men. Apply—Knight's (Hendon) Ltd., 42, Watford Way, N.W.4. 133

ENGINEER required for large cotton spinning mills as assistant to head engineer. Should have experience of Babcock & Wilcox boilers, Metropolitan-Vickers steam turbines. Engineering shop practical work in all kinds of repairs to machinery parts. Apply in writing to the Personnel Officer, J. & J. Hayes Ltd., Victoria Mills, Leigh, Lancs. 1166

ENGINEER to take charge in transformer winding shop, West London. Excellent opportunity to gain management experience. Ordinary National Certificate a minimum. State previous winding experience (if any), age, salary required, married or single.—Box 1077.

ENGINEERING & LIGHTING EQUIPMENT Co. Ltd. wish to engage an assistant in the street lighting fittings sales department. Experience in sales correspondence and knowledge of the lighting industry desirable. Applicant must be capable of interviewing prospective customers. Good education and address essential. Write, stating age, experience and salary required, to—Sphere Works, St. Albans, Herts. 1067

ENGINEERS and technicians required for training in the installation of auto. tele. exchange equipments. 24 to 30 years of age, willing to travel and work any part of U.K. A knowledge of electricity is essential. Excellent prospects. Write stating experience and technical qualifications.—Siemens Brothers & Co. Ltd., Ref. 427, Woolwich, S.E.18. 688

ESTIMATING engineer required by electrical contractors, London. Must have held similar position and be capable of dealing with all types of large electrical installations. Apply, giving full details of experience, age and salary required to—Box 9676.

ESTIMATOR and supervising engineer required; must be capable of tendering for complete private and industrial installations. Apply, stating full particulars and salary required, to—Messrs. Christy Bros. Limited, 171, Broomfield Road, Chelmsford. 9666

ESTIMATOR required with experience in preparing tenders for all classes of A.C. and D.C. electrical rotating machinery, switchgear, etc., and familiar with standard specifications; 5-day week; pension scheme. Applications should state age, full details of experience, salary expected, to—Personnel Manager, Lancashire Dynamo & Crypto, Trafford Park, Manchester, 17. 1068

FOREMAN electroplater and enameller, 35/40 years of age, with not less than 20 years' experience of which 5 years must have been in charge of large plating and polishing shop engaged in finishing to specification requirements on mass production lines the many varieties of parts used in the electrical industry. Only first-class men capable of controlling and organising a large department should apply, giving full particulars of experience and salaries received, to—The Phœnix Telephone & Electric Works Limited, The Hyde, Hendon, N.W.9. 1112

EXPERIMENTAL. First-class instrument maker required for experimental department. Experience with small mechanisms and diaphragm units associated with aircraft instruments essential. A knowledge of electrical and electronic devices would be an advantage. Write in first instance, giving full particulars of age and experience and rate required, to—Mechanism Ltd., 6a, George St., Croydon. 960

FEMALE cost clerk for electrical contractors, Westminster, preferably with experience of electrical terms. Please state experience and salary required.—Box 892.

FIRM of consulting and manufacturing engineers require a number of senior, intermediate and junior electrical electro-mechanical and mechanical draughtsmen for rearmament project work in their Bath and Weston-super-Mare offices. Good-class lodgings are available to single and married applicants, also flatlets. Come and work in the beautiful West Country. Good salaries will be paid to successful applicants.—Box 994.

FOREMAN electrician required to take charge of planning and installation of all electrical work on large civil engineering contract in North Wales. Power installations and maintenance of all electrical plant, only men with similar experience need apply. Accommodation. Subsistence allowances. Salary according to experience. Full particulars—Box 921.

JUNIOR diagram draughtsmen required in London with experience of H.T. switchgear and modern power station practice. When applying, please state age and experience. —Box 48.

JUNIOR engineers interested in radio/radar and servo-mechanisms are required in special English Electric Company laboratory, working on new defence project. Preference given to applicants with Ordinary or Higher National Certificates in Electrical Engineering. Progressive position, commencing salary £400-£600 p.a., according to qualifications. Write, giving full details of age, qualifications and experience and quoting ref. 815A, to—Central Personnel Services, English Electric Co. Ltd., 24/30, Gillingham Street, London, S.W.1. 1150

LAMP making: Wanted, foreman to take full responsibility for the quantity and quality of production in stem-making section of lamp works, handling a large variety of stems on a full range of machines, including hand, semi-automatic and fully automatic. Only men with full experience need apply and a substantial salary will be paid. Housing assistance, if required, will be given to the successful candidate and superannuation benefits are available.—Box 867.

LIGHTING engineer required by lamp and lighting equipment manufacturers, E.L.M.A. members, to prepare commercial and industrial lighting specifications. Central London office. Nat. Cert. E.E. and I.E.S. member preferred, age 25/30. Experience essential. Assistants provided. State full particulars and salary required to—Box 806. 1154

LINESMAN, overhead, experienced, required contract North Borneo, 12 months, excellent conditions, large firm electrical engineers and contractors. Write age and experience.—Box 946.

MAINTENANCE electrician required, preferably conversant with the maintenance of electric furnaces, overhead cranes, foundry and engineering works equipment. Full particulars to—Wellworthy Piston Rings Ltd., Ringwood. 1153

MALAYA. Electrical engineer with mechanical experience required for tin mine in Malaya with own hydro-electric power station. Age 25-30, preferably single. Applicants should have served recognised apprenticeship, be A.M.I.E.E., or have equivalent technical training. Term three years with liberal salary, annual increments and h.c.l. allowance, also provident fund. Free passage and quarters. Write, stating age and full details of qualifications and experience, to—Box J.642, c/o Streets, 110, Old Broad Street, London, E.C.2. 1089

MANAGER for electrical and radio showroom in West End of London. Experienced in purchasing and sales. Write, stating age, experience and salary required, to—Box K.349, Willings, 362, Gray's Inn Road, London, W.C.1. 1061

OVERHEAD line construction. Scottish organisation require technical engineers and assistants, site engineers and assistants, surveyors, foreman linesmen and linesmen. Good prospects, good salaries and wages, superannuation scheme. Apply in confidence to Box 1154 giving full particulars and salary required.

PRODUCTION engineer as an assistant to the production manager of a British Columbia company manufacturing H.T. and L.T. switchgear and allied products. Engineer with electrical-mechanical background preferred and with administration and engineering ability. Reply in writing before April 25th giving particulars of age, experience and qualifications to—A. J. Goodwin, Chief Engineer, Cemco Electrical Mfg. Co. Ltd., c/o British Columbia House, 1, Regent Street, London, S.W.1. 9679

PLANNING and supervising engineer required for expanding electric supply corporation in West Pakistan. Applicant should have had a wide and continuous practical experience in the design, operation and maintenance of a growing supply undertaking's industrial and rural network of overhead lines and underground cables at voltages up to 33 kV. Preference will be given to applicants in possession of a university degree in electrical engineering or other technical qualification of equivalent standing, or to Corporate Members of the Institution of Electrical Engineers. Salary according to qualifications. Leave and passage terms will be in keeping with qualifications. Successful applicant will be expected to enter into an agreement for a period of at least three years. Apply, stating salary expected, to—Box 943.

POWER transformer estimating engineer required immediately. Age about 25. One holding Higher National Certificate preferred. Apply, stating age, experience and salary required.—Box 942.

PROTOTYPE instrument maker with a knowledge of toolmaking required by N.W. London precision engineers. Write, giving age, experience, etc.—Box 1065.

REQUIRED: Electronics/electrical designer, take charge of design and dev. wide range covering electronic welding and process controls, small spot welders, rectifier units up to 50 kW. Valve and relay circuitry experience essential. Should have degree or equivalent, with practical outlook. State age, experience and salary required.—Hirst Electronic Development Ltd., Dermody Rd., London, S.E.13. 992

RESPONSIBLE electrical sales engineer required by well-known company to act as chief sales representative in the Midlands area. A remunerative appointment with excellent prospects offered to the right man. Must know the territory thoroughly, with good connections amongst electrical manufacturers, wholesalers and contractors. Applications with full particulars, please, to—Box 1018.

SENIOR designer-draughtsman required for interesting development projects. Switchgear experience preferred, but experienced draughtsman capable of working on own initiative considered. Apply, stating experience, qualifications and salary required, to—The Personnel Manager, Cooke & Ferguson Limited, Openshaw, Manchester, 11. 1111

SENIOR draughtsmen with up-to-date experience of H.T. switchgear wanted. Please state qualifications, age and salary required. Apply—The New Switchgear Construction Co. Ltd., Wellesley Rd., Sutton, Surrey. 809

SENIOR engineer wanted for experimental work on servo-mechanisms for modern high-speed project in special English Electric Company laboratory. Good experience in servo loop design essential. Honours degree preferable. Progressive position, with commencing salary £700/900 p.a. Write, giving full details and quoting ref. 844B, to—Central Personnel Services, English Electric Co. Ltd., 24/30, Gillingham Street, London, S.W.1. 1151

SENIOR transformer tester required. Air and oil-cooled transformers up to 20 kVA. Permanent progressive position. Write, stating experience, qualifications and salary required, to Box 1092.

SEVERAL vacancies exist in the development laboratory of the General Electric Co. Ltd., Witton, for development engineers in the electronics, small motor engineering and high-power switchgear test sections. Applicants should preferably possess a degree or Higher National Certificate in electrical engineering, but those taking their final examination this year will also be considered. Salaries will depend upon qualifications, age and experience. Apply in writing, giving full particulars, to—Staff Manager, General Electric Co. Ltd., Witton, Birmingham, 6. 1014

SOUTH WALES SWITCHGEAR Ltd., Blackwood, Mon., have vacancy for chief storekeeper. Please send applications stating age, experience and salary required. 1036

SPECIALIST sub-trades-manager. Mainly electrical and plumbing, but other trades usually sub-contracted, jobbing, etc., might be included as subsidiary to well-known firm of public works contractors. All necessary assistance will be given by parent company, but man appointed will be responsible for own estimating, etc., and will be expected to act on own initiative. Good salary and bonus will be paid, and permanent pensionable appointment provides splendid opportunity for practical man with necessary technical and administrative experience. Full particulars, including previous employers, positions held and salaries earned, in confidence to—W. Simmons & Co. (Stratford) Ltd., 13, Frederick Street, London, E.15. 1088

SWITCHGEAR specialists require contract engineers for Manchester works to prepare engineering projects up to 132 kV on H.V. systems in Canada, South Africa and Australia, in addition to B.E.A. contracts. Attractive salary commensurate with experience. Reply in confidence, stating age, experience and salary, to—The General Manager, Messrs. Cooke & Ferguson Limited, Openshaw, Manchester, 11. 776

SALES correspondent required by electric light fittings manufacturers in North London. Some experience in the industry desirable but not essential. Age about 25 to 30. Write, giving details and salary expected, to—Box 1090.

TECHNICAL assistant with knowledge of structural design of overhead line supports and street lighting columns required by firm manufacturing steel poles. Experience of estimating in connection with light structural steelwork essential. The situation is in the Birmingham area. Canteen facilities, pension scheme and five-day week are in operation. Apply, stating age, experience, training and salary required, to—Box 842.

THE BRUSH ELECTRICAL ENGINEERING Co. Ltd., Loughborough, have vacancies in their transformer department for draughtsmen with good basic training in general engineering. Previous transformer experience not essential. Excellent opportunities for advancement under good working conditions for the right type of men. Applicants should write, giving full details of training, experience, etc., to—Central Labour Dept. 935

TRANSFORMER technical cost estimator required for preparation of estimated costs from design and cost statistics. Design experience an advantage. Apply by letter, quoting "Transformer" and giving age, qualifications and salary required, to—Staff Manager, General Electric Co. Ltd., Witton, Birmingham, 6. 1149

URGENTLY required for expanding iron and steel works in Southern Rhodesia, electrical engineer, maintenance fitters and electricians, bricklayers, draughtsmen, traffic foreman, sample passers and pitside foreman. Only men who have sufficient steelworks experience and who are prepared to settle in Rhodesia will be considered. Interested applicants apply to John Miles & Partners (London) Ltd., Consulting Engineers, 76, Cannon Street, London, E.C.4, who will supply details of wages and conditions of service. When applying, applicants should state experience, age and give full information. 1064

WANTED, an experienced electronics engineer to take charge of investigations into effect of anti-vibration measures in special English Electric laboratory. Starting salary £500-£600 p.a., according to qualifications. Write, giving full details and quoting ref. 850A, to—Central Personnel Services, English Electric Co. Ltd., 24/30, Gillingham Street, London, S.W.1. 1152

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

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OVERSEAS, BUSINESS & RESEARCH EXPERIENCE

QUALIFIED ELECTRICAL AND ELECTRONICS ENGINEER experienced in business abroad and research is available for appointment offering attractive salary and opportunity for advancement. Has excellent service record with major companies. Will discuss various ways of fitting into your organisation. Please write:—
Box 9662

ELECTRICAL foreman (41) accustomed to high-class work seeks post as foreman or site engineer London area.—Box 9661.

ELECTRICAL engineer (37), married, with extensive practical and theoretical experience coupled with sound administrative, commercial and organising ability, at present engaged as sales manager/buyer well-known export organisation, seeks progressive executive position, home or in Empire.—Box 9640.

ENGINEER (23), Grad.I.E.E., experience of generation and transmission, switchgear, rectifiers, H.P. boilers, turbines, etc.; apprenticeship, 2 yrs. in D.O. preparing schemes and estimates, seeks interesting post Southern Counties.—Box 9663.

ENGINEER, 36 years' varied experience all aspects contracting, desires appointment London or South. Buying, costing, accounts, estimations, administrative position.—Box 9632.

EXECUTIVE 25 years' commercial experience electric cable industry contemplates change provided position carries responsibility. C.M.A. also non-association sales and estimating (home and export), purchasing, works progress and transport experience, mainly paper cables. Excellent personal connections.—Box 9658.

GRAD. I.E.E. (25), 4 yrs.' experience in relay circuit design of remote and automatic control systems and associated apparatus design, seeks interesting design or development post.—Box 9672.

JOINTER (plumber), all voltage cables to 33 kV.—Box 9683.

H.F. induction heating applications engineer seeks position of responsibility, home or abroad. Age 28. H.N.C. in elec. eng. Experience well-known firm employing H.F. technique to production methods.—Box 9627.

PRODUCTION executive, age 36, seeks situation. 20 years manufacturing measuring instruments and radio equipment, experienced mixed labour, planning and progress, accustomed quantity production to high standard, long association leading manufacturer.—Box 9669.

WORKS executive (42), apprenticeship and 20 years' subsequent extensive experience in works management and detailed staff organisation related to manufacture of rotating electrical machines, fans, switchgear, seeks position of responsibility on manufacturing side of industry, where minimum £1,600 per annum can be earned by initiative and drive to obtain results.—Box 9677.

YOUNG Swiss electrical engineer will take any employment, if possible in electro-technical branch or motor-car industry, for purpose of learning English.—Box 9680.

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ELECTRIC MOTORS, 400/440/3/50

225-h.p. Internal S/R Motor by A.S.E.A., type M.22, open protected frame, 2 endshield oil bearings. Mounted on C.I. bedplate, shaft fitted pulley 28 in. diam. × 28 in. face, for flat belt drive. Rotor volts 482, rotor amps. 208. Speed 485 r.p.m. Complete with control gear.

170-h.p. Compensated Induction Motor by E.E.C. (suitable for power factor correction), size AGS.C16, protected type frame with endshield b/r bearings. Standard shaft extension fitted vee-rope pulley. Commutator machine with ext. sliprings. Speed 720 r.p.m. With control gear.

86-h.p. S/R, HOLMES, speed 485 r.p.m., protected type. Rotor volts 250, rotor amps. 180.

Two 75-h.p. S/R Motors by L.D.C., screen protected type with endshield ball bearings. External T.E. cont. rated sliprings. Rotor volts 245/268, rotor amps. 142/129, speed 485 r.p.m.

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ALL THE ABOVE and numerous other types IN STOCK.
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TENDERS are invited for the purchase of the following Diesel Generators located at the above hospital.
(1). BLACKSTONE, 32-h.p. Diesel Engine (1937), 200 r.p.m., horizontal (single cylinder), 7' diameter fly wheel. Method of starting, compressed air with Higg 110-v, D.C., 22-kW Dynamo (850 r.p.m.).
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A. W. YOUNGS,
Glangwili, Secretary.
Carmarthen.
4th April, 1951. 114

HOUCHIN DIESELS

DESIGNED and built for hard, continuous work. Ideal as a standard power unit for factories, building works and a host of other uses—or as an emergency reserve unit. Compact, rugged, reliable and fully portable.
100 kVA, .8 power factor, 3 voltages available (110, 220, 440), 3-phase, 4-wire, 50 cycles, 1,500 r.p.m., G.M.C. diesel engine 6-71 series, 126 h.p., continuously rated. A completely self-contained plant.
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NEWMAN INDUSTRIES LIMITED are pleased to announce that they have been appointed Sole Selling Agents for the United Kingdom for FRANCO TOSI and SISMA Diesel Engines.
The following are available for early delivery :—
One 1,000-kW, 300-r.p.m. and two 600-kW, 375-r.p.m. engine-driven Alternator Sets.
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100 kVA ALPHA HARRIS, 400/3/50, 1,000 r.p.m., new b/b.
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163

A Babcock & Wilcox water-tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap. 200 lb. w.p. Two 25,000 lb. evap. 250 lb. w.p. One 20,000 lb. evap. 175 lb. w.p. Two 16,000 lb. evap. 190 lb. w.p. Two 12,000 lb. evap. 200 lb. w.p. We install complete, including brickwork. — Burford, Taylor & Co. Ltd., Boiler Specialists, Commercial Street, Middlesbrough (Tel. Middlesbrough 2622). 32

A BARGAIN in electric motors can always be obtained from A. Cooksley & Co. Ltd., 21-25, Tabernacle St., London, E.C.2. Tel. Monarch 3357. Stocks at present comprise new squirrel cage motors, 1-25 h.p., also new and secondhand slipring motors, with starters, from 7½ b.h.p. to 30 b.h.p. 50

A QUANTITY of secondhand 3-h.p. motors, 710 r.p.m., 440 volts, 3-phase, 50 cycles, screen protected and fitted with ball bearings, arranged for direct starting. Makers, Veritys Ltd. One 20-h.p. motor, 720 r.p.m., 440 volts, 3-phase, 50 cycles, fitted with ball bearings and bedplate; also oil-immersed starter for this motor complete with ammeter, overload coils and no volt. Makers, E.D.M. & Crypto. Offers will be considered for the lot, or separate motors.—Atkins Brothers (Hinckley) Ltd., Bond St., Hinckley. 1050

ABSORPTION refrigerator units for 3 cu. ft. cabinets (220/230 v.), new, complete with heating element and thermostatic control, £15 each.—Electrical Products Co., 55, Long Lane, London, E.C.1. 9645

A.C. and D.C. house, quarterly and prepayment meters. —Electric Meter Co., Castor Road, Brixham. 9688

A.C. and D.C. house service meters, all sizes, quarterly and prepayment, reconditioned, guaranteed one yr. Repairs and recalibrations. — The Victa Electrical Co., 47, Battersea High St., S.W.11 (Tel. Battersea 0780). 138

A.C. and D.C. motors, all sizes, large stocks, fully guaranteed.—Milo Engineering Works, Milo Road, East Dulwich, S.E.22 (Forest Hill 2278-9). 102

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 8631-4). 91

A.C. and D.C. motors, new and re-conditioned, from stock. Diesel generators and compressor sets.—Springdale Eng. Co. Ltd., 40, Spring Street, London, W. 2 (PAD. 9002). 9656

A.C. Metrovick B.T.H. motors, ¼ h.p., 200/250 v., 50 c., 1-ph., 1,425 r.p.m., new, £5 10s. 9d.; ½ h.p. £6 11s. 8d.; ¾ h.p. £8 16s. 10d.; 2 h.p., capacitor start, £14 15s. 8d.; 1 h.p. £17 9s. 5d.; discounts to trade; also 3-phase and D.C. Guaranteed repairs and rewinds.—Johnson Engineering, 319, Kennington Road, London, S.E.11 (Reliance 1412-3). 99

A.C. variable speed drive, new, L.S. & E., 6 h.p., 346/3/50, 4-wire, 1,400/720 r.p.m., Brookhirst control panel and P.E. box. Various D.C. motors. Send for list. —A. C. Dibley & Co. Ltd., 72, Granville Road, Cricklewood, N.W.2. 997

ALTERNATOR, 44 volt, 3-phase, 50 cycles, for 4 wire use, 32 kVA, complete with D.C. exciter on a common frame driven by V belts. May be inspected at Leicester by arrangement with R. A. Haigh, Chartered Accountant, Court Chambers, Friar Lane, Leicester, to whom all offers should be made in writing quoting reference 90/7. 1162

ANODISING machines, 2,600 amps. and 800 amps., 60 volts, from stock. Also large stock of plating generators. —Fyfe, Wilson & Co. Ltd., Bishop's Stortford. 1122

AUTOMATIC telephone switchboard, with eliminator and telephones, 20-line. Will install and guarantee for twelve months. — Box 9674.

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B.A. stainless steel screws and nuts, ex stock.—Premier Screw & Repetition Co. Ltd., Woodgate, Leicester (Phone 5695). 148

BATTERY chargers, 4 models, 2-6-12 v., 1-2-4 amps., D.C., any mains voltage; also larger types, special transformers, chokes, test gear, interior car heaters, etc.—The Banner Electric Co. Ltd., Hoddesdon, Herts. 97

BRASS "½" lampholders, cordgrip lampholders, brass battenholders and all bakelite electrical accessories for disposal.—Alexander Jager Trading Company Limited (Primrose 8778). 9629

B.T.H. 1-h.p., 220/240-volt D.C., 2,850-r.p.m. motor. Price £13 10s.—Universal Electrical Co. 221, City Road, London, E.C.1. 947

CAPACITORS: 112 .2 + .2 mfd. condensers suitable for operation at 7,000 v. D.C. across each condenser section, 14,000 v. D.C. across the two sections. Manufactured by Johnson & Phillips Ltd. New and unused. Communicate with Platt Metals Ltd., Metalex Works, Gt. Cambridge Rd., Enfield, Middx. (Enfield 3425). 1095

B.T.H. oil circuit breaker (type OCB/250/OR250), complete with oil-cooled rotor starter, pedestal mounted, suitable for 165-h.p. motor, 415 v., 50 c., 3-ph.—City Sewage Engineer, Leek Road, Stoke-on-Trent. 1078

D.C. contactor starter, automatic, 2·5 h.p., 110/220 v., for remote control, new, each £2; 110-v. D.C., 1½ h.p. faceplate starters, double automatic, new, each £1.—Brand Electro-Mobive Ltd., 321, Smithdown Rd., Liverpool, 15 (Sefton Park 1033). 9633

DIESEL electric plants, from 3-20-kVA output, with remote push-button control and automatic voltage control; prompt delivery; 3-kVA pattern with Petter engine, £195.—Ward, Lordscroft Works, Haverhill, Suffolk (Tel. 253). 167

DIESEL generating sets, brand new and fully guaranteed, Lister 3.5 kW to 9 kW, A.C. and D.C.—Alliance Electrical Co. Ltd., 2, Henrietta St., London, W.C.2. 854

DIESEL generating sets, English manufacture, direct current, all voltages, from 50 kW to 260 kW.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 158

DIESEL generating sets, English manufacture, 3-phase, all sizes from 50 kW to 260 kW.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 157

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 13

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Rd., London, N.W.10 (Colindale 4621-2). 42

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 34

EX W.D. rotary converters, 12 and 24 volts D.C. input, 230 volts A.C. output, 85 w., complete with choke, condenser and leak transformer, in metal cases 6 lbs. each, carr. paid.—Philpott, Fountain Sq., Fenton, Stoke-on-Trent. 9659

EXPORT enquiries welcomed for reconditioned quarterly and prepayment meters, immediate delivery.—Electric Meter Co., Castor Road, Brixham. 9686

FOR sale: Cable, 6,600 v., 3-core, .075 P.I.L.C.S.W.A., two lengths, 75 yards, 6 yards; circuit breaker, Ellison, 400 v., 150 kVA, oil-filled. Apply—Thomas De La Rue & Company Ltd., Portobello Works, Warwick. 949

FOR sale, 120-h.p., 3-bearing, Metro-Vick motor, 500 volts, 50 cycles, 710 r.p.m., complete with auto transformer air break starter.—Wolfhill Spinning Co., Ltd., Ligoniel, Belfast. 1161

FOR sale: 1,000-kW generator, 440 v. D.C., 580/600 r.p.m., three-wire; also 550 kW, 220 v. D.C., 300/480 r.p.m.—Fyfe, Wilson & Co. Ltd., Bishop's Stortford. 1123

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GENERATING Sets, petrol engine-driven alternators, 220/240 volts, single-phase and 3-phase.—Britannia Manufacturing Co. Ltd., 22-2t, Britannia Walk, London, N.1. 160

GENERATING Sets, petrol engine-driven dynamos, 110 volts and 220-240 volts, direct current.—Britannia Manufacturing Co. Ltd., 22-26 Britannia Walk, London, N.1. 159

GENERATING Sets, petrol, 5 to 15 kVA, single-phase, 50 periods, 230 volts.—Midland Counties Elec. Eng. Co. Ltd., Grice Street, West Bromwich. 43

HOUSE service meters, C. & H., Aron, E.A.C., 20-240 v. A.C., s.-ph., 50 c., 2½ amps., 7s. 6d. each, 1s. 6d. postage; 5 amps., 17s. 6d.—Universal Electrical, 217-221, City Road, London, E.C.1. 129

HOUSE service meters, from 5/-, guaranteed two years.—Electric Meter Co., Castor Road, Brixham. 9687

MERCURY switches are made by Hall, Drysdale & Co. Ltd., of 58, Commerce Road, Wood Green, London, N.22 (Tel. Bow 7221). 182

METERS, A.C. and D.C., new and reconditioned, all types. Quarterly, single and three-phase, 3 and 4 wire, 2½ to 1,000 amps. Prepayment, single and double tariff, single, dual and triple coin, fixed and variable tariff, 2½ to 50 amps. M.D.I., billiards switches, rent collectors. Prices from 5/- carriage paid, guaranteed for ever, immediate delivery. Illustrated catalogue from—The Electric Meter Co., Castor Road, Brixham. 9684

METERS, A.C. or D.C., quarterly or slot, guaranteed, sent on approval if desired.—Brent Electrical Co., 6, Holmdale Gardens, London, N.W.4. 131

METROPOLITAN-Vickers, 40/45-h.p. squirrel cage motor, A.C., 725 r.p.m., 440 v., 50 c., 3-ph. Overhauled.—City Sewage Engineer, Leek Road, Stoke-on-Trent. 1079

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MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Rd., London, N.1 (Tel. Clerkenwell 5512, 5513 and 5514). 28

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PREPAYMENT meters, all types.—Electric Meter Co., Castor Road, Brixham. 9689

PREPAYMENT 1s. Slot House Service Meters.—Universal Electrical, 217-221, City Rd., London, E.C.1. 56

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RIGHTWAY pulley drawers, suitable for pulleys, couplings and wheels up to 20 in. dia. For details send to—Electric Machinery Co. M/cr. Ltd., Union St., Ancoats, Manchester. 85

ROTARY convertors in stock, all sizes, enquiries invited.—Universal Electrical, 221, City Road, London, E.C.1. 16

SLOT-meters, A.C. and D.C., all types, illustrated list—Electric Meter Co., Castor Road, Brixham. 9685

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WE have purchased a considerable quantity of anodisers, plating generators, 15/60 volts, also miscellaneous plating plant, etc. Enquiries invited.—Barking Machinery Traders Ltd., Wykeham Works, Highbridge Rd., Barking (Rippleway 3293). 1116

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10-kVA alternator sets. Ideal for country house, etc., 10 kVA, 230 v., 50 cycles. Complete wtih exciter, voltage regulators, switchboard, frequency meters, ammeters, and iron-clad switch fuses for output. Mounted on angle-iron stand and complete with vee belt pulley. Designed to run at 1,500 r.p.m., but being belt driven they can be driven by an engine of any speed; unused. Price £85 each.—E.P.E. Ltd., 42-46, Windmill Hill, Ruislip Manor, Middlesex. 19

12½-kVA, 400-v., 3-phase generator set, complete with exciter, voltage regulator and control panel, with instruments; direct driven by 4-cylinder Pelapone petrol-governed engine. Can be seen running, excellent condition, £275 ex works.—Trianco Limited, Imber Court, East Molesey (Tel. Emberbrook 3300). 822

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NOTICE is hereby given that The English Electric Company Limited seeks leave to amend the Complete Specification of the Application for Letters Patent No. 521605 for an invention entitled "Supporting means for axle-hung electric motors on electrically propelled vehicles." Particulars of the proposed amendments were set forth in the Official Journal (Patents), No. 3241, dated 29th March, 1951. Any person may give Notice of Opposition to the amendment by leaving Patents Form No. 36 at the Patent Office, 25, Southampton Buildings, London, W.C.2, on or before 30th April, 1951.—J. L. Blake, Comptroller-General. 1026

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(*Continued from page* 88)

The products of the Group were essential to the life of the country. Whatever the future might hold the A.E.I. Group had an indispensable part to play. The stern tasks of rearmament and the threat of war brought many new problems. They could face them in the confidence that they were well equipped with machines and loyally served by all those who worked in their factories.

The report was adopted. 1073

COMPANY MEETINGS

Copy can be accepted up to first post on Monday for publication on the following Friday.

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ASSOCIATED ELECTRICAL INDUSTRIES

Increased Production

Mr. Oliver Lyttelton's Speech

THE Fifty-first Annual General Meeting of Associated Electrical Industries Limited was held on 3rd April in London.

The Rt. Hon. Oliver Lyttelton, D.S.O., M.C., M.P., the chairman, said that 1950 had once again been a year of increased production, but they had not maintained the same rate of increase which had been achieved over the last three years. The figures had been affected towards the end of the year by the decision of the hourly rated employees at the Trafford Park works of Metropolitan-Vickers to work only on day work and to abandon piece work. Piece work had, however, been resumed in February, 1951.

The further increase in production in 1950 was achieved without any increase in the numbers at work. The apparent rise in the number employed to 55,000 was accounted for by the inclusion in the figures for the first time of those employed by wholly owned subsidiaries overseas.

Deliveries of finished apparatus amounted to more than £55,000,000 sterling during the year. The result was due in the main to the large sums which the Group companies had expended upon new equipment since the war. However highly equipped their factories might be, that massive output could only be gained through the keenness and enthusiasm of all those employed by the Group.

The amount invested in the company by the Ordinary Stockholders, either by cash subscriptions or by retention of profits, now amounted to £28,000,000, and if stockholders confirmed the final dividend recommended by the Board the return to stockholders on the true capital invested would be about 4¼%. During the five years 1946/1950 nearly £19,000,000 had been invested in the business by stock and loan issues or by the retention of profits.

Burden of Taxation

It was again necessary that stockholders should realise how heavy a burden of taxation the company had to bear. During the three years 1948-1950 the company had paid in income tax and profits tax more than £10,000,000, and the Ordinary Stockholders had received dividends amounting to £3,000,000 before the deduction of income tax, or £1,650,000 net. The figure paid out for wages and salaries for the period was £57,000,000 and included an increase of 17% in the average earnings of those employed. In the current year the company would have paid in taxation more than five times the distributed profits.

From the net profits of the year £1,250,000 had been transferred to General Reserve, which now stood at £8,250,000. Other Reserves had been increased by £120,000 and now stood at £2,290,000. Last year they had made a transfer from Other Reserves to General Reserve of £1,250,000. Although they had not done so this year they would repeat those transfers from time to time, since the distinction between the two classes of reserve was nominal rather than real.

Orders Exceed £100,000,000

The total orders on the books greatly exceeded £100,000,000 in value, but they were well spread out over the next three or four years.

The stockholders would expect him to say something about the effects of rearmament upon the company's fortunes. Their principal preoccupation, of course, concerned the maintenance of a free flow of raw materials for their manufacturing plants. The difficulties were likely to be serious; at the same time he must point out that in any rearmament programme the electrical industry must be one of the highest priority, and they had some hopes that those shortages would only affect a small part of their business.

They must, however, expect difficulties in maintaining the production of certain types of their lighter electric appliances. Any falling off was likely to be more than offset by armament orders in the heavier sections. They had planned, as the armament programme advanced, that those of their factories engaged on such products as domestic appliances should be organised for the manufacture of components for the heavier side. It was not possible to make those changes without some dislocation, but as far as they could see the over-all effect would not be serious.

(*Continued on page 87*)

TELEGRAPH CONSTRUCTION & MAINTENANCE

Encouraging and Satisfactory Results

THE 87th Annual General Meeting of The Telegraph Construction & Maintenance Co. Ltd. was held on 10th April in London, the Rt. Hon. Lord Colgrain, the chairman, presiding.

The following is an extract from his circulated statement for the year ended 31st December, 1950:—

The balance of Trading Account £307,408 shows an increase of £12,601 over that of last year. This balance does not include a sum of £14,201, being a 20% dividend from our subsidiary, The Selborne Plantation Co. Ltd.

The net profit is £160,924. The Board now recommend a final dividend of 5%, making a total distribution for the year of 10%. The Directors, after due consideration, propose to augment the final dividend of 5% by distributing in addition the 1% on issued capital which was reserved last year. I explained then our reasons for this step, and as, in the opinion of the Directors, that position no longer applies, the dividend will be at the rate of 6%, being the 5% for the final dividend for the year under review plus the 1% reserved last year in "Revenue Reserves and Undistributed Profits."

Re-equipment Scheme

Last year I referred to the hope that there might be some relief in taxation to help to defray the rising cost of plant replacement, but there has been no such relief, and it becomes increasingly difficult to provide for natural extension and re-equipment, more especially as the cost of plant has risen so steeply in the last few years. During the past year we have made a very careful study of this matter and have adopted a steady and progressive scheme for the mechanisation and re-equipment of our factory over a prescribed period. The scheme also takes account of and incorporates such programmes of expansion of certain lines of business which our market researches predict will be profitable and should be beneficial in balancing our sales and productivity capacity. This programme will, over the course of the years, need considerable financial outlay and our reserves, though considerable, are by no means in excess of what will be required to meet our plans, and it will consequently be necessary to continue our policy of placing to reserve substantial sums from profits. In connection with the further amount placed to the Reserve for Research and Development, we must provide for further scientific and technical developments which are being carried out to an ever greater extent in the engineering industry and which are so vital.

In my statement last year I told you of the unfortunate lack of home orders for paper-insulated power cable, and expressed the hope that the Treasury would realise the need to relax their restrictions to allow the natural expansion of electrification and so to provide a healthy home business to assist in our exports. Although this hope was not realised during the year, the results from our Power Cable Department were very satisfactory in view of the scarcity of orders. I am glad to say, however, that the position has now improved and there are ample orders to enable this Department to make a good start in the present year.

Metals Division

The Metals Division made an excellent contribution to the trading results and has started the new year with a good order book. I am quite confident of its ability to assist in the rearmament programme, given adequate supplies of the various non-ferrous metals which it requires. The rolling mills to which I referred last year have been operating very successfully, but the business which was anticipated has unfortunately been temporarily stopped due to lack of raw materials. Our scientists are actively engaged in endeavouring to make these meagre supplies go further by the use of new compositions, and present indications are that these new alloys will be acceptable.

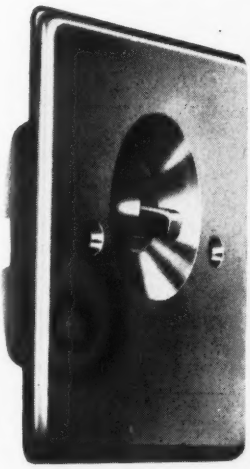
Our High Frequency and Communication Cable Departments have also had a satisfactory year and been reorganised to some extent to meet changes in the type of business. Exports have increased beyond last year's values and there is every reason to look forward to a good year.

I would also like to make some reference to the results of our associated company, Submarine Cables Ltd., which, as you know, is owned equally with Siemens Brothers & Co. Ltd. The amount of submarine cable manufactured in our works during the year has been a record, both in volume and value, since the formation of the company in 1935. Its present order book is large and its future prospects excellent. I must, however, repeat that raw materials will constitute a very serious difficulty in the immediate future, though, in view of the importance of good communication systems to an integrated Western Europe and the North Atlantic nations, no doubt considerable supplies may be expected for this vital business.

The report was adopted. 1167

THE YARDSTICK of

SWITCH VALUE



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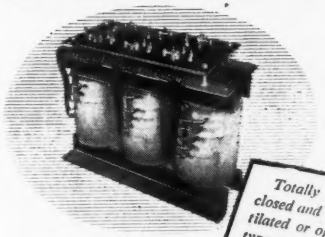

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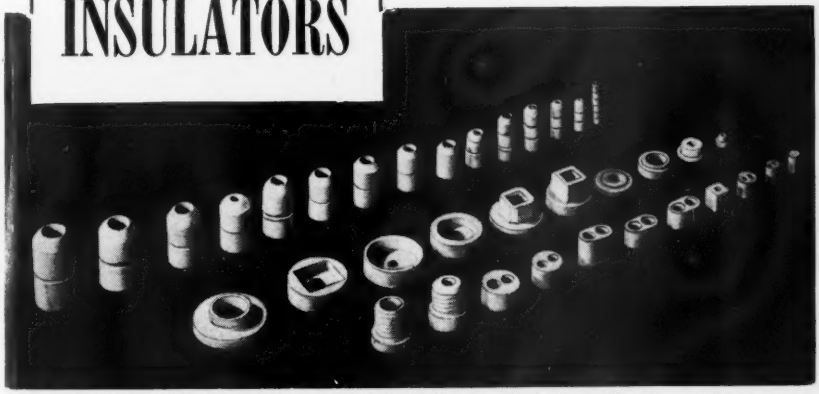

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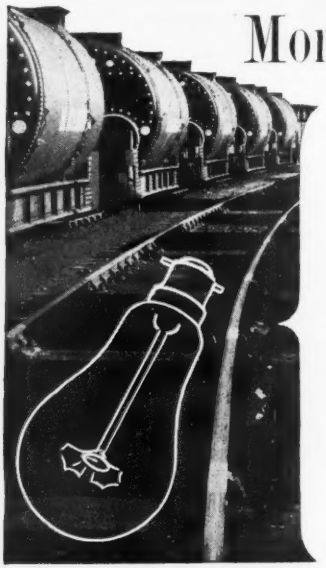

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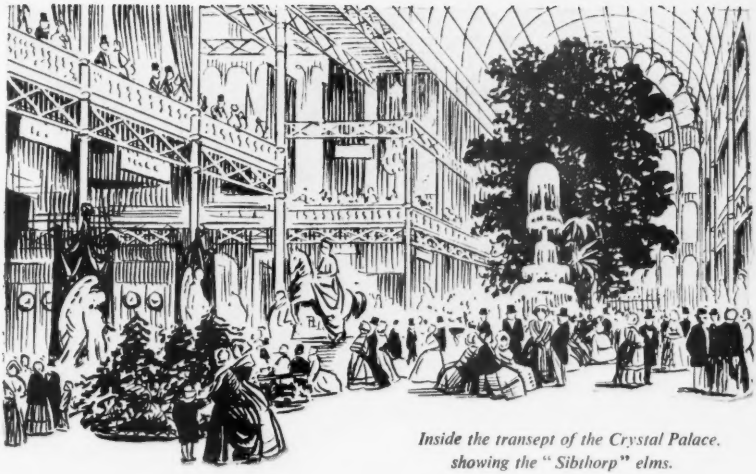

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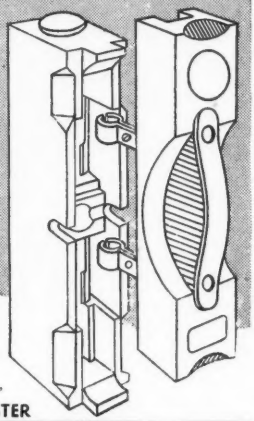

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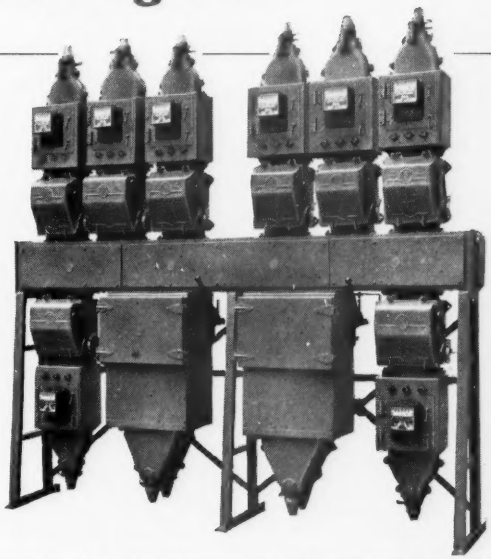

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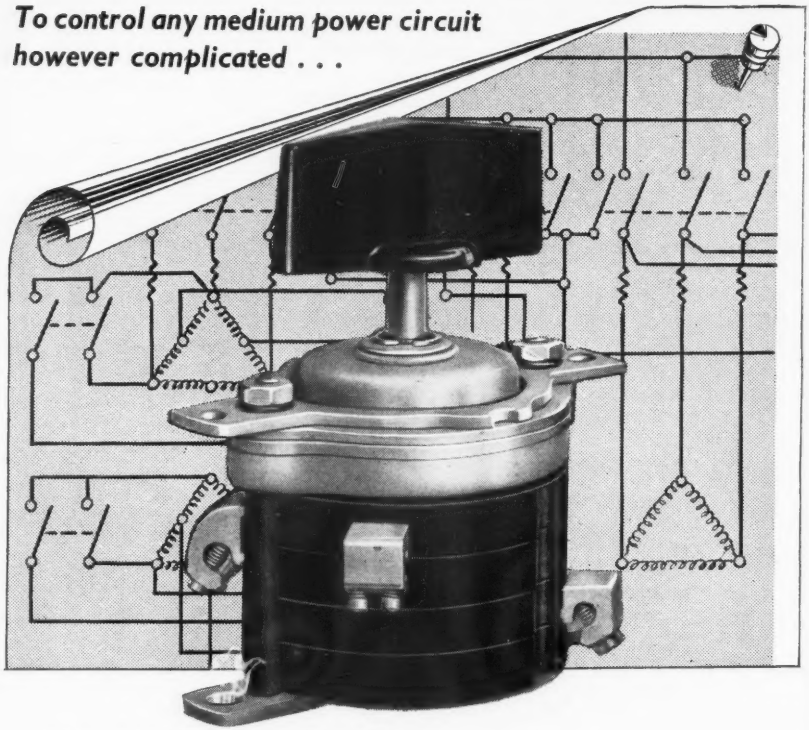

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"Permanently Visible Check" on Production Lines at Rover Works

The Rover Works at Solihull and INSET, *an Eversheds Tachometer Indicator.*

The Rover Car Company, whose works at Solihull are playing so important a part in the export drive of high-quality British cars, use Eversheds Tachometer equipment to aid in the centralised control of production so essential in a full-out effort.

An Eversheds Tachometer transmitter is coupled to the driving motor of a King Conveyor. From this motor a shaft running beneath the floor drives four production lines—Body and Paint, Trim Finish, Chassis and Mount, and final inspection and polish—which are spread in parallel across the really vast shop. The transmitter is linked to an Eversheds Tachometer Indicator in the centrally placed Production Manager's Office, and to an Eversheds Tachometer Recorder in the Chief Planning Office.

The Indicator serves as a "permanently visible check" on the four production lines mentioned, while the Recorder supplies the Company's planners with a permanent always-at-hand record of this information. The Indicator is particularly useful at present in showing power load shedding, which causes the driving motor speed to fall, as a fall "cars per hour" reading : so that steps can be taken at once to bring the motor up to normal speed again.

Eversheds Tachometers have a variety of applications throughout industry to provide similar checks upon current production in terms either of machine speeds or labour output : and to record this information in a permanent form as a basis for economical planning. *Full details will be found in Publication D224.*

"Four Advantages" of Eversheds Recorder

A small electricity undertaking states that its Eversheds Chart recorder has "four advantages."

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2. Load indication helps efficient plant operation—sets of different capacity can be arranged as required.
3. Recordings prove operation times and approx. kW demand of certain large users.
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Eversheds Recorders are described in Publication D222.

STEEL TUBE *production at Jarrow is aided, too, by Eversheds instruments—a Recorder detailing power consumed on any single tube, and peak loads and times with any class of steel: and a Speed Indicator in constant use.* Send for Publication D222 (Recorders): Publication D224 (Tachometers).

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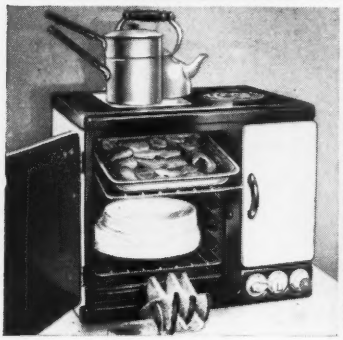
(Patent applied for)



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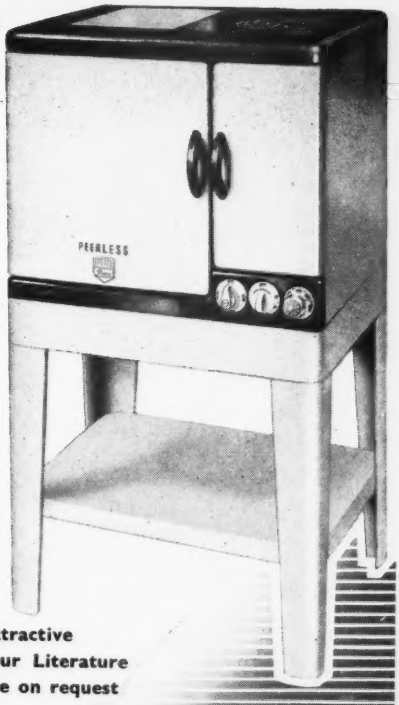

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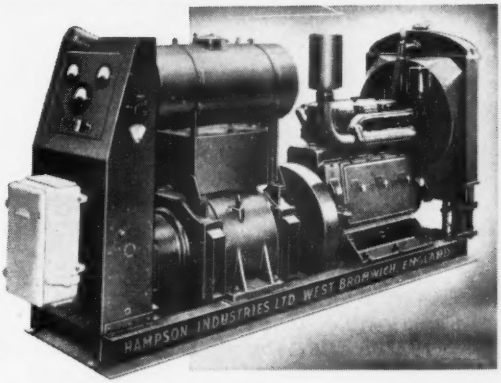

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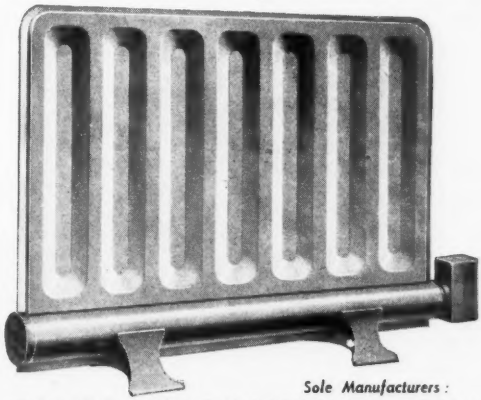

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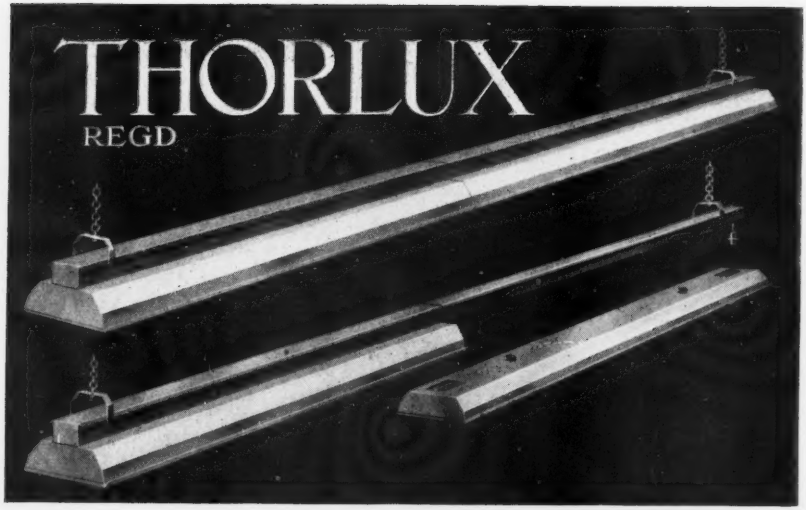

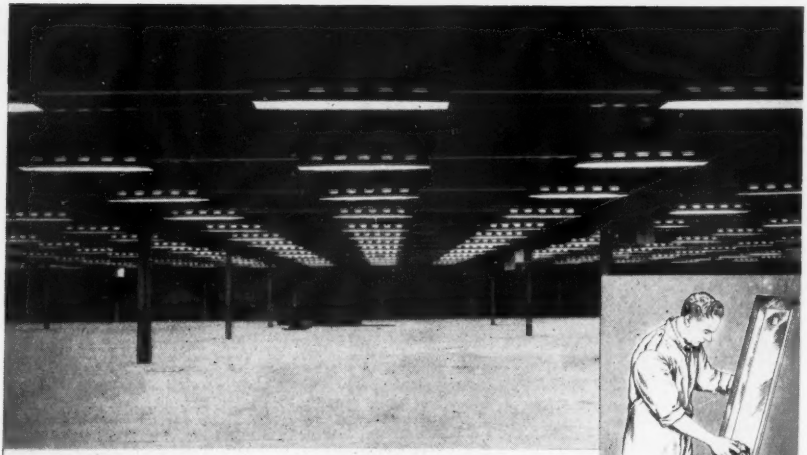

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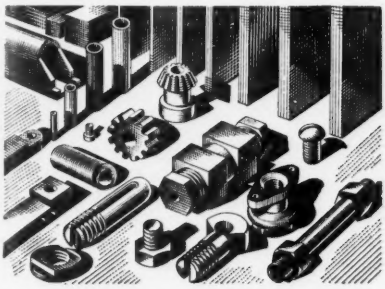

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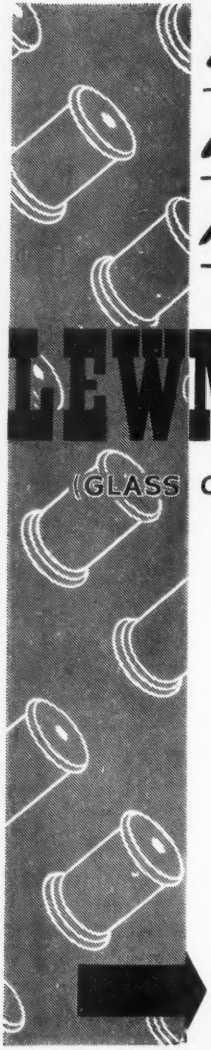

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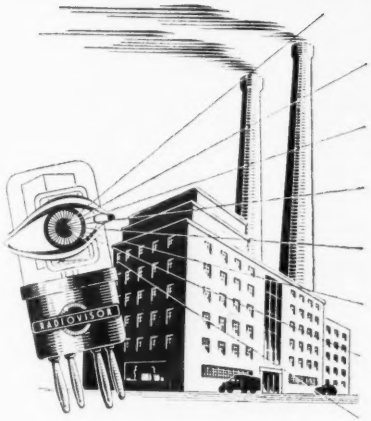

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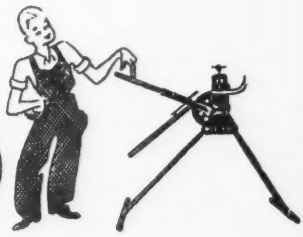

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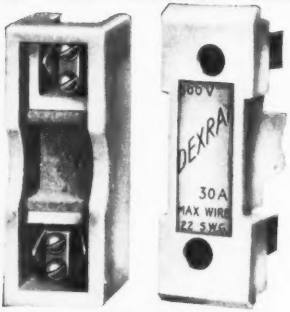

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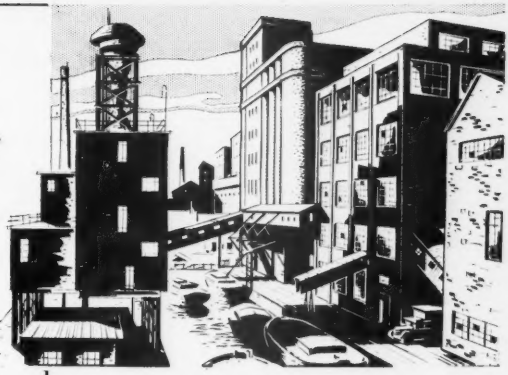

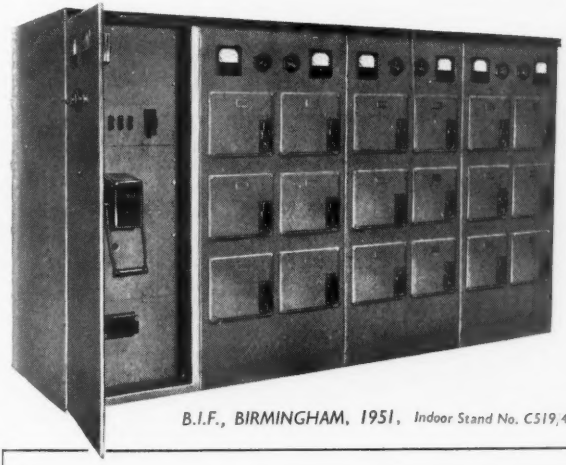

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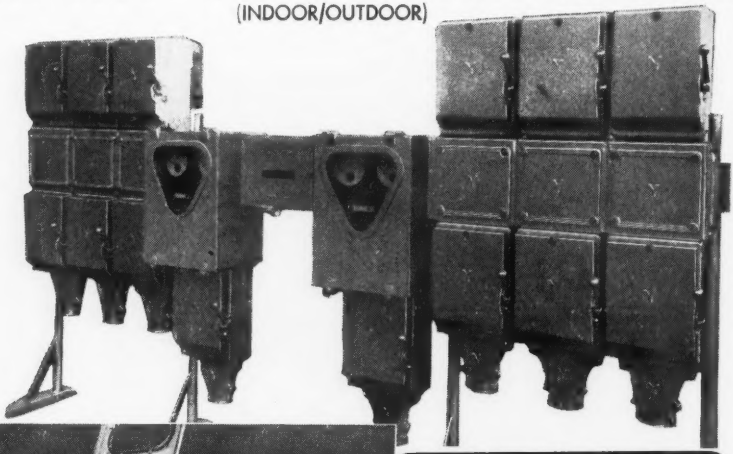

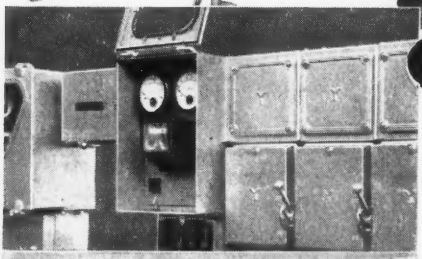

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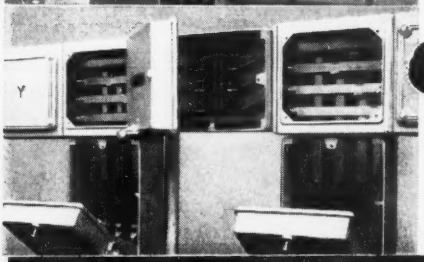

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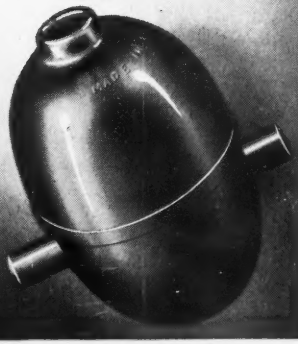

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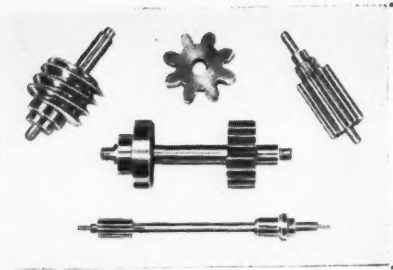

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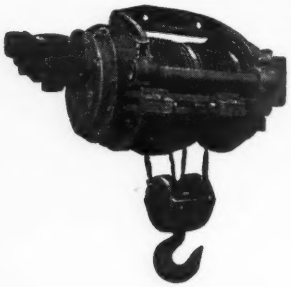

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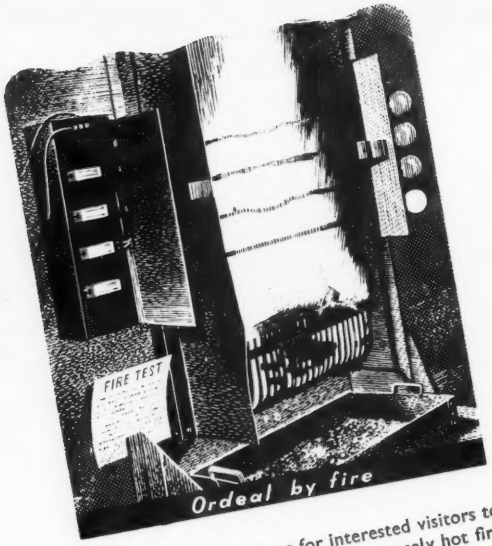

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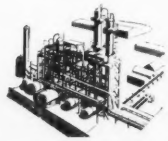

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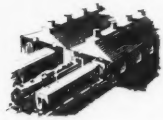

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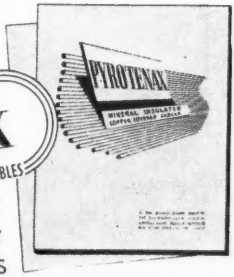

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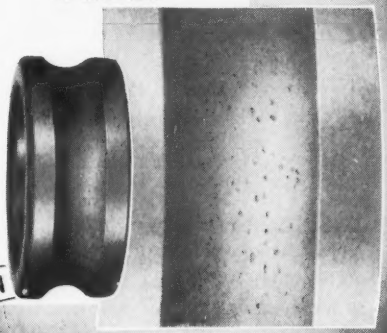

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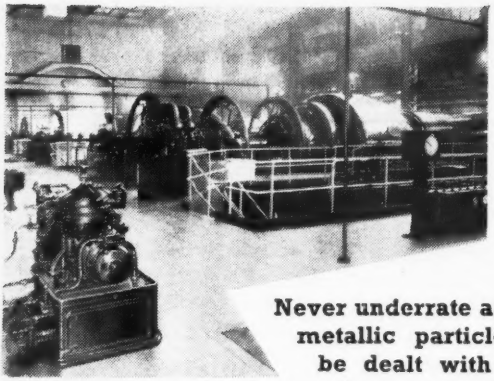

Fulham Power Station, showing De Laval TYPE 4024 Turbine Lubricating Oil Equipment By courtesy of B.E.A.

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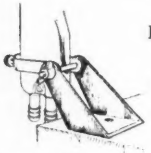

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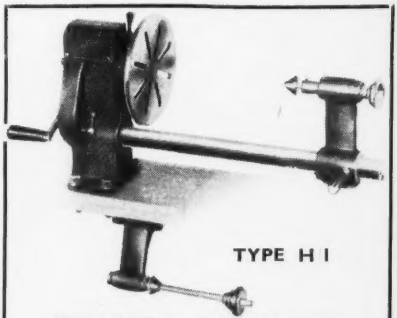

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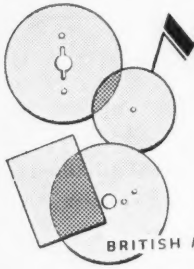

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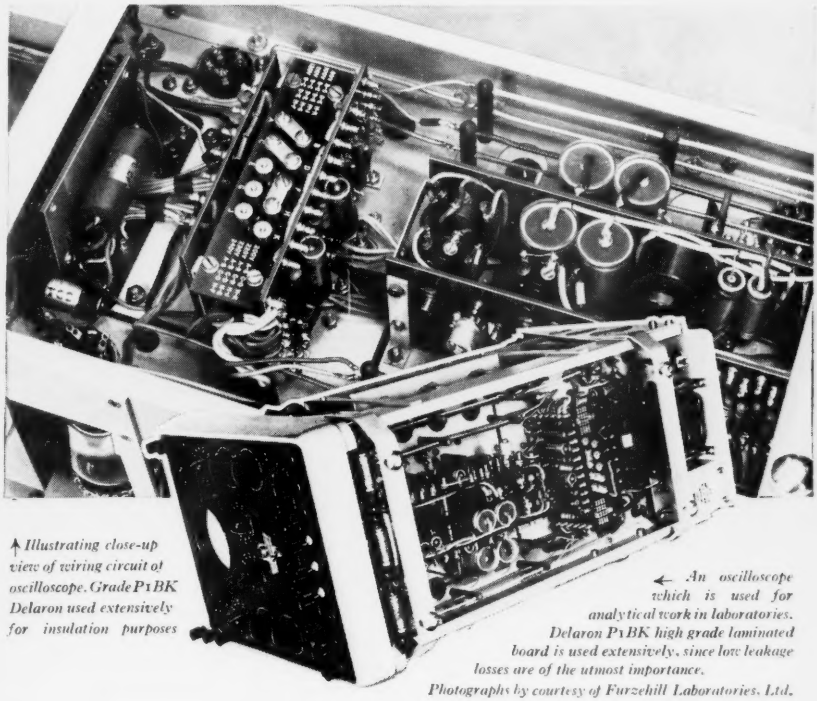

↑ *Illustrating close-up view of wiring circuit of oscilloscope. Grade P1BK Delaron used extensively for insulation purposes*

← *An oscilloscope which is used for analytical work in laboratories. Delaron P1BK high grade laminated board is used extensively, since low leakage losses are of the utmost importance.*

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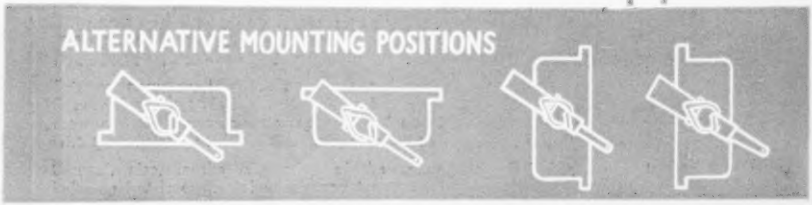
Publication 93662ZI giving full particulars available upon request.



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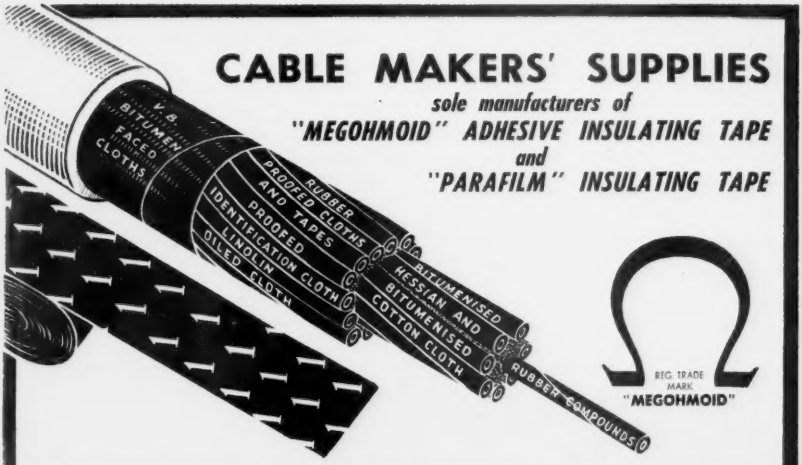

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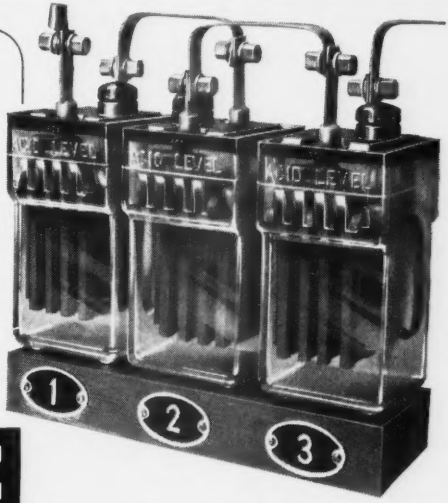

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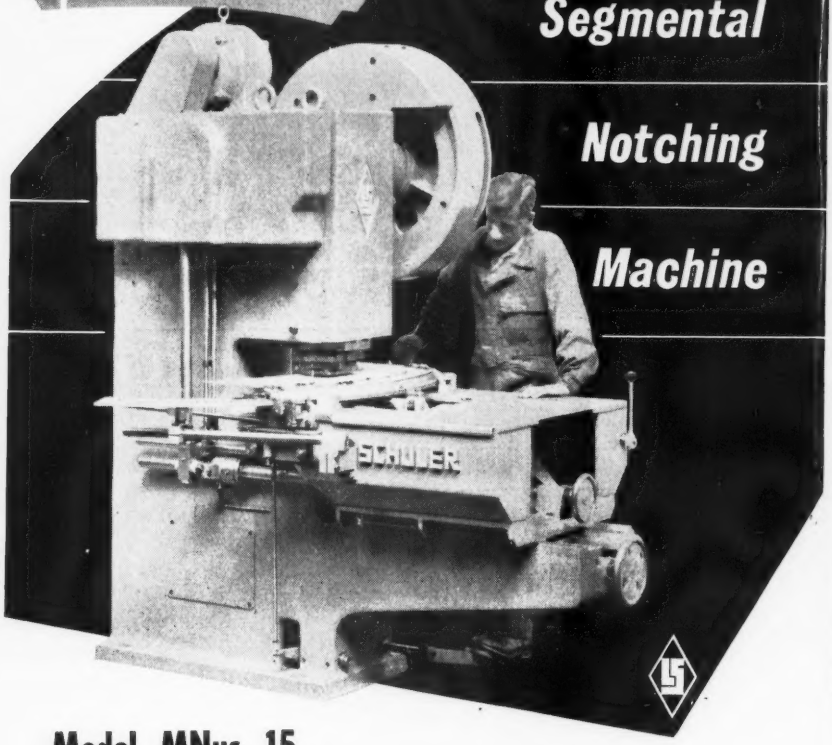

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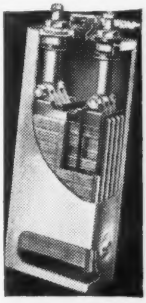

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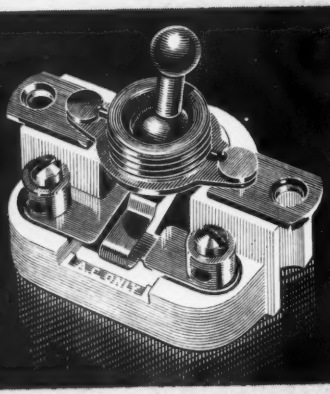

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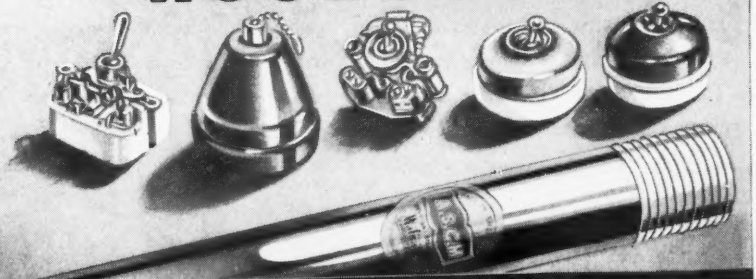

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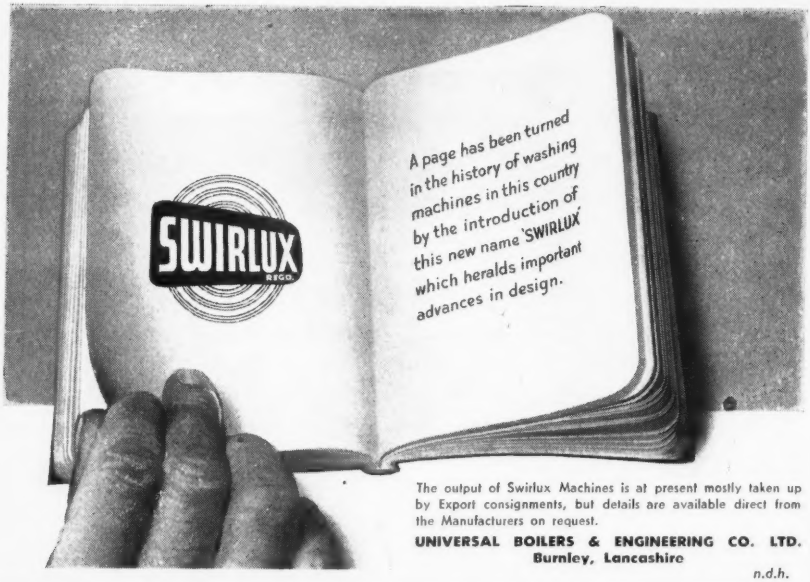
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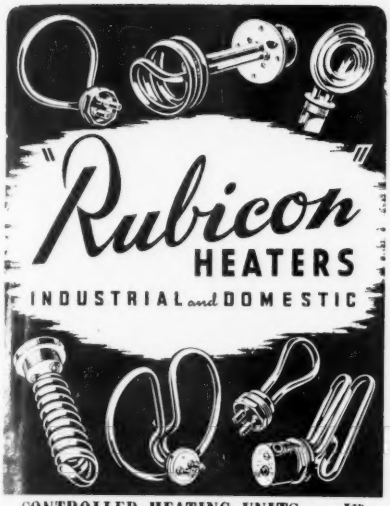

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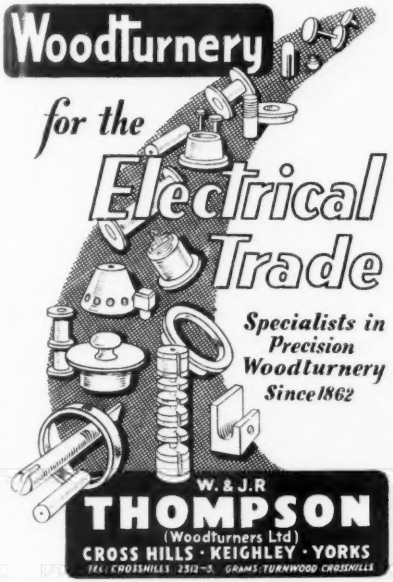

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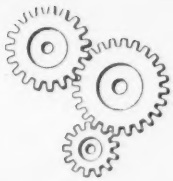

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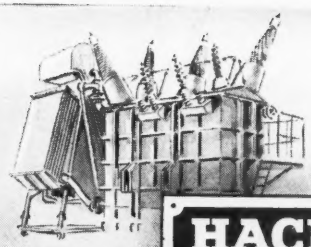
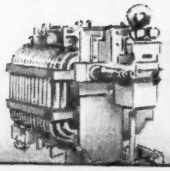
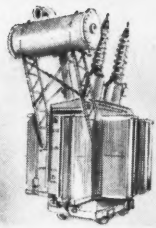

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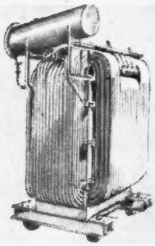
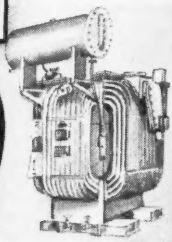

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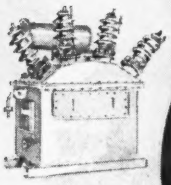
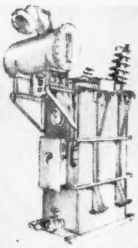
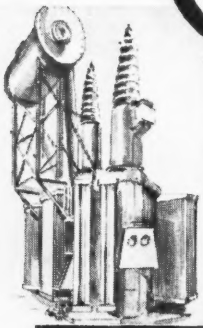
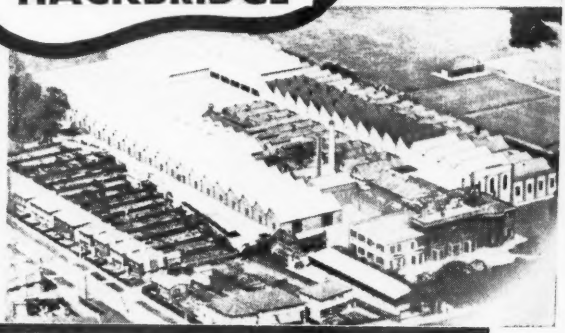

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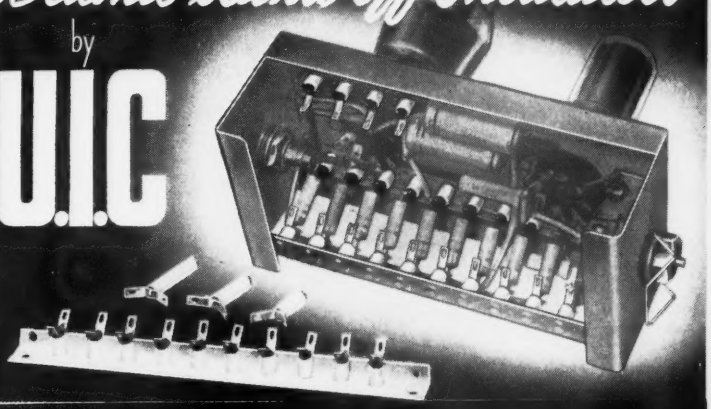

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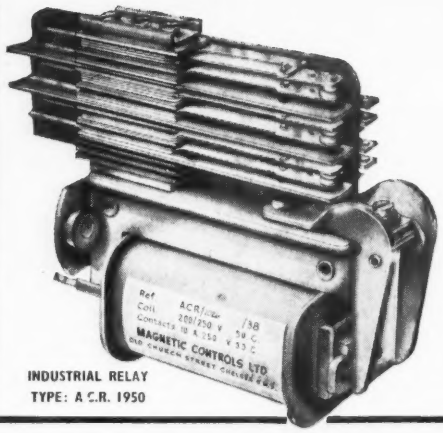

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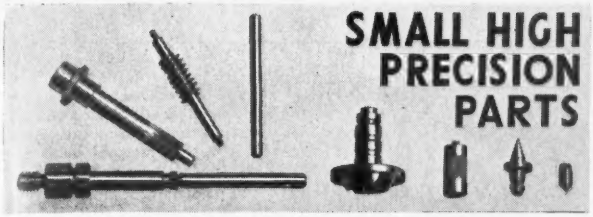

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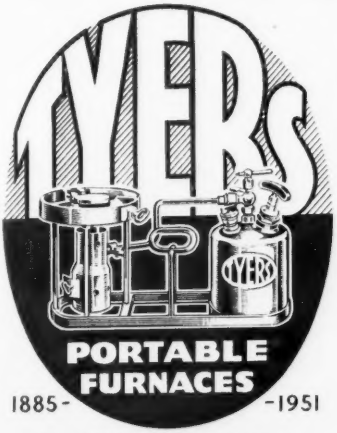

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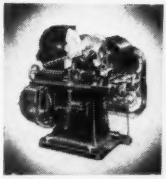

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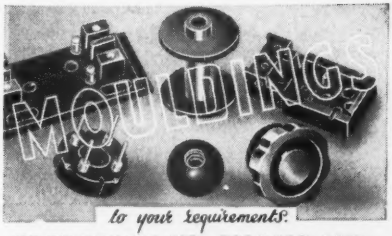

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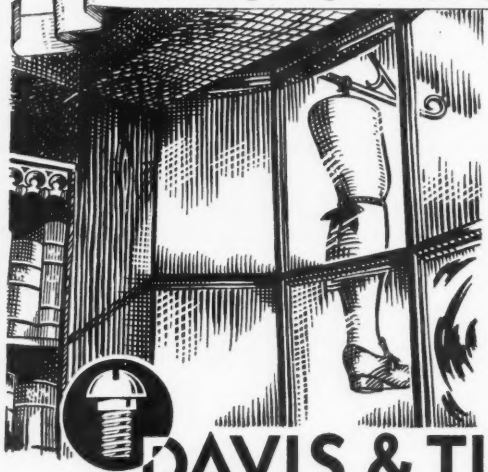

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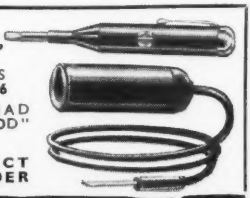

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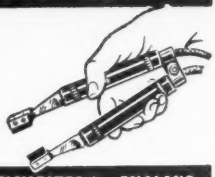

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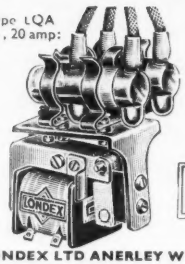

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